UPPER ASSINIBOINE RIVER BASIN STUDY

SUMMARY AND RECOMMENDATIONS

Environment Canada Environnement Canada

Sask Water

Manitoba Conservation

THE STUDY

In October 1996, the governments of Saskatchewan, Manitoba and Canada agreed to conduct this study of the Upper Assiniboine River Basin. The Study was initiated as a result of the 1995 flood and other issues including drainage and flood control and the disappearance of valuable wetland habitat. In addition, there was uncertainty regarding sustainable water supplies for municipal, industrial, agricultural and recreational purposes and lack of knowledge regarding the hydrologic and ecological processes and their effects at work within the Basin. There was also growing concern about water quality and uncertainty regarding appropriate aquifer management and protection. This Study provides information on the Basin's water resources, as well as information and recommendations on which to base decisions affecting future water management.

ASSINIBOINE RIVER BASIN

THE BASIN

The Upper Assiniboine River Basin is located upstream of the confluence of the Assiniboine and Qu'Appelle rivers. The Basin encompasses about 21,000 square kilometres – 79 per cent in Saskatchewan and 21 per cent in Manitoba. Major tributaries are the Whitesand River, Shell River, Lilian River, and Yorkton Creek. The Basin features several lakes including Good Spirit Lake, Fishing Lake and Lake of the Prairies, the largest lake in the Basin.

About 60,000 people live in the Upper Assiniboine River Basin. Economic activity and land use within the Study area are dominated by agriculture, primarily mixed grain and wheat farms. Small livestock operations are found throughout the area and the development of feedlots and intensive livestock operations is becoming more common. The Basin supports a diverse wildlife population.

LOCAL INVOLVEMENT

The wide variety of water management issues, the deeply rooted views held by many of the Basin residents, and the immediacy of the problems reinforced the importance of ensuring public awareness and participation was fully integrated within the Study process. This was achieved through the formation of six Local Watershed Committees.

Representatives of local rural and urban governments, regional watershed or development associations, wildlife and recreation groups, and other interested area residents comprised these committees. The committees provided input to Study activities and communicated with area residents about Study progress and results.

CONCLUSIONS

Four technical committees undertook the work of the Study with public involvement through six Local Watershed Committees. Following is a summary of the conclusions of each technical committee.

DRAINAGE AND FLOOD CONTROL

- Climatic processes dominate the generation of major flood events.
- The greatest impact of drainage of wetlands is during moderate runoff events, with the effect diminishing for increasingly larger flood events.
- Drainage of wetlands has little effect on major flood events.
- Effects of land cover changes and wetland drainage in the Basin could not be quantified, but a trend of increasing runoff volume was detected.
- Increased runoff volumes into lakes gives rise to management problems and reduces operational flexibility of reservoirs.

WETLANDS

- Temporary and seasonal wetlands are the most common categories in the Basin. They are as important for wildlife breeding and foraging as more permanent wetlands.
- In some areas, an average of 45 per cent of the wetland area has been removed. Temporary and seasonal wetlands are most impacted by agricultural activities. In some areas, up to 75 per cent of the temporary wetlands and up to 80 per cent of their margins were cultivated.
- Wetlands and native uplands provide a source of domestic water, livestock watering and forage, recreational activities, and non-consumptive uses such as hunting, trapping, fishing and eco-tourism.
- Wetlands help to control erosion. They also recycle, immobilize and concentrate nutrients.
- Producers see wetlands as an additional liability because no financial incentive is provided to them to retain the wetlands for conservation benefits.

WATER SUPPLY AND USE

- At both the current and future level of water use, surface water supply is generally sufficient, although it is less reliable in the headwaters of the Basin. As with all prairie areas, the Basin is subject to droughts.
- The preliminary analysis suggests that sufficient water is available for instream flow needs (aquatic ecosystems) and offstream uses, but during periods of low flows there may be conflicts over water use.
- Apportionment between Saskatchewan and Manitoba is not an issue in the Basin at the present time or in the foreseeable future.
- There is no reliable method to determine the effect of drainage or climate change on the supply and use relationship.
- No aquifer management plans other than one currently being developed for the Yorkton aquifer system are contemplated, although additional developments may make them necessary.

WATER QUALITY

- In general the water quality is suitable for its expected uses. There are areas where limitations to such uses as irrigation are evident. It is important to note that in some cases the assessment is based on a limited quantity of data.
- Some of the impacts of agricultural land drainage on water quality include nutrient loading, pesticide contamination, heavy metal contamination, erosion and sedimentation. As well, water quality benefits accrued by wetland retention are lost when wetlands are drained.
- Key points that could be targeted for the agricultural industry include the proper handling and application of farm chemicals, appropriate methods and locations for cleaning sprayers and empty containers and use of container disposal sites. Testing for the effects of hazardous substances in landfills, container collection sites and discontinued bulk fuel depots and gas stations is also important. The industry could also look at the development of Best Management Practices for annual cropping and livestock management.

- Proper decommissioning of abandoned wells, proper maintenance of existing wells and proper siting and construction of new wells are all factors to be considered in protecting water quality.
- There is little integrated database management among the variety of agencies collecting data. As a result, much of the information regarding groundwater availability and quality is lacking continuity and can be difficult to obtain.
- Without long-term monitoring, it will be impossible to adequately protect the Basin's groundwater since changes will not be detected until contamination is widespread.

RECOMMENDATIONS

WATERSHED MANAGEMENT

1. Watershed plans should be developed with local involvement as a basis for land and water management, development and conservation. One or more pilot projects to undertake watershed planning should be initiated as soon as possible.

2. Proposed drainage projects should be planned and approved within the context of a local watershed plan which considers the impacts at downstream locations. The plan should include operating guidelines for controlled drainage works and backflood projects so that downstream damages are minimized.

3. Measures should be taken to ensure the availability of adequate supplies of good quality water in all areas of the Basin. In particular, the expected expansion in livestock production will require a dependable supply of good quality water.

4. Instream flow needs for maintenance of aquatic habitat and fisheries should be an integral part of future water management, particularly when changing the operating guidelines for a dam and when granting new water allocations.

5. Water quality should be taken into consideration when evaluating drainage projects. Criteria should be established for rating or evaluating drainage projects. A code of practice should be developed for construction of drainage projects to reduce impacts on water quality. The cumulative impacts of drainage on water quality should be considered in the context of a watershed plan.

BEST MANAGEMENT PRACTICES

6. Where drainage projects are approved, the construction of works such as backflood projects or controlled drainage should be promoted to minimize adverse downstream effects.

7. Best Management Practices for agriculture and other industries should be developed and promoted with emphasis on surface water and groundwater protection.

8. Agricultural practices such as conservation tillage and permanent cover programs which retain or reestablish perennial cover should be promoted as means to reduce runoff rates and volumes.

9. The livestock industry should be encouraged to improve riparian areas through alternative pasturing, livestock watering systems, and properly located and managed winter feeding sites.

10. Maintenance of natural vegetation cover around water bodies should be encouraged. Licensing preference should be given to drainage works that include establishment of vegetation cover such as grasses to protect drainage channels from erosion. Buffer strips or bush adjacent to water courses or water bodies should be protected to reduce the potential for erosion or contamination of the receiving water body.

11. Wells should be properly sited, constructed, maintained and decommissioned to protect groundwater from contamination.

POLICY, LEGISLATION AND ENFORCEMENT

12. A planning and approval process should be developed to support landowners and government resource management agencies in determining appropriate levels of development.

13. An effective regulatory framework for drainage should be established which takes into account the resources and expertise required for proper review and enforcement.

14. Provincial and local governments should ensure that additional development does not occur within flood prone areas through a review of the processes for subdivision approvals and granting of building permits.

15. Economic and other factors faced by producers in their decision whether or not to drain wetlands should be considered in the development of environmental, social, or economic programs or policies to address drainage issues.

16. Regulations should be reviewed that apply to the construction and monitoring of facilities such as landfills, lagoons, chemical storage and pesticide container disposal sites. (Saskatchewan)

17. Agencies responsible for surface water and groundwater management and protection should be encouraged to develop a joint database of the current status of water quality.

EDUCATION AND DEMONSTRATION

18. Water management agencies should expand efforts to promote awareness of the hydrologic processes that lead to floods, especially large floods, as well as the effect of water control projects on flow rates and water levels.

19. Information should be provided on the value and proper application of manure as a nutrient-rich fertilizer.

20. Education activities should be implemented to caution pesticide users to avoid cleaning sprayers and chemical containers near open water and to apply product at the proper rates and follow label restrictions and recommended practices.

21. A public education program on proper well and aquifer management should be initiated to protect groundwater formations from contamination.

22. Agencies should provide coordinated and effective communication to the public and stakeholders on land management issues that affect surface water and groundwater.

23. Information and extension programs should be developed to increase awareness of the importance of wildlife habitat (wetlands, uplands, and riparian areas) in the Basin as well as the opportunities to implement land use activities that will benefit both agriculture and wildlife.

RESEARCH AND STUDIES

24. Water and wetland management agencies should:
    - develop criteria to assist landowners in planning and resource managers to identify wetland and upland habitat that requires protection;
    - collect further data for very small, shallow wetlands to provide greater confidence in applying the area/volume relationship in the range of wetlands subject to contour ditching and V-ditching;
    - develop instream flow guidelines;
    - investigate structural and non-structural means to improve operational flexibility of the reservoirs;
    - undertake aquifer characterization including aquifer production capabilities and water quality analysis to define the groundwater supply and facilitate economic development;
    - develop aquifer maps to define various aquifers in the region with an emphasis on unconfined or vulnerable aquifers;
    - determine any long-term effects of lagoons on receiving water bodies through more extensive studies and monitoring; and
    - review the required quality of wastewater effluent and the procedures for its release to receiving waters.

25. Research agencies should:
    - develop remote sensing technology for application to the detection of wetland drainage;

- continue investigations into the relationship between snowmelt runoff and agricultural practices such as stubble management, conversion to permanent cover and clearing of bush;
- continue research and development of practical watershed modeling tools which can be used by provincial regulatory agencies to assess the impact of drainage projects on watershed hydrology, and;
- develop watershed models with improved simulation of hydrologic processes on the Canadian Prairies such as variable contributing area and wetland storage.

MONITORING AND ASSESSMENT

26. An enhanced water monitoring program should be implemented in the Basin to obtain data on actual surface water and groundwater usage and to ensure that all major usage is licensed and appropriately monitored. Efforts should also be made to improve the timely analysis of data where warranted.

27. Provincial agencies should continue to monitor developments in remote sensing technology with a view to future application in the detection of wetland drainage.

28. Water and wetland management agencies should define common standards and definitions in the assembly of wetland databases.

29. An inter-agency working group should be formed to continue assessing the hydrologic effects of wetland drainage and land cover change in the Basin using the knowledge base developed in this Study.

30. Studies should be conducted to determine if engineering works are a practical method of reducing the risk of flood damages to existing developments in flood prone areas.

31. Testing of private groundwater wells should be encouraged.

32. Groundwater monitoring should be done in the vicinity of potential sources of contamination (e.g., manure storage sites, chemical collection depots, landfills, discontinued bulk fuel depots, and gas stations) to determine whether contamination is occurring.

33. Long-term monitoring of surface water quality and riparian health on a watershed basis should be implemented. Monitoring should be carried out to collect information to confirm the current status of water quality and identify potential problems in the Basin.

INCENTIVE PROGRAMS

34. Programs should be developed to encourage the retention of remaining natural wetlands to conserve habitat.

35. Programs should be developed to encourage retention of those wetlands that provide significant benefits in controlling snowmelt runoff into the stream network in most years.

36. Partnerships for the conservation of wetland and upland habitat should be pursued with non-government agencies and other interested parties.

37. Beaver management programs should be developed. Specific problem areas in the Basin should be identified. Local governments and resource management agencies should work together to target management efforts.

38. Programs should be developed to encourage the adoption of compatible land use practices in flood prone areas in order to reduce damages to agricultural lands and urban developments located adjacent to streams and water bodies.

For more information, contact:

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November, 2000

Upper Assiniboine River Basin Study

Main Report

November 2000

Environment Canada Environnement Canada

Sask Water
Our Water...Our Future

Manitoba Conservation

Executive Summary

Background

The Upper Assiniboine River Basin is that portion of the Assiniboine River Basin upstream of the confluence of the Assiniboine and Qu'Appelle rivers. The Basin is shared by Manitoba and Saskatchewan and encompasses about 21,000 square kilometres, with 79 per cent in Saskatchewan and 21 per cent in Manitoba. Major tributaries are the Whitesand River, Shell River, Lilian River and Yorkton Creek. Several natural lakes are found in the Basin, most notably Good Spirit Lake and Fishing Lake. Lake of the Prairies, formed by Shellmouth Dam is the largest lake in the Basin.

About 60,000 people live in the Upper Assiniboine River Basin. Economic activity and land use within the Study area are dominated by agriculture, primarily mixed grain and wheat farms, although pasture and hay lands are also common. Small livestock operations are found throughout the Study area and the development of feedlots and intensive livestock operations is becoming more common. The Basin supports a diverse wildlife population. The quality of the larger sources of surface water in the Basin is generally acceptable for most uses. The Basin's groundwater is generally of good quality, although there may be limited availability in some areas.

In October 1996, the governments of Saskatchewan, Manitoba and Canada agreed to conduct this study of the Basin. The Study was initiated as a result of the 1995 flood and other issues including drainage and flood control and the disappearance of valuable wetland habitat. In addition, there was uncertainty regarding sustainable water supplies for municipal, industrial, agricultural and recreational purposes and lack of knowledge regarding the hydrologic and ecological processes and their effects at work within the Basin. There was also growing concern that the quality of water was deteriorating and uncertainty about appropriate measures for aquifer management and protection. This Study provides information respecting the Basin's water resources and information and recommendations on which to base decisions affecting future water management.

Conclusions

Four technical committees undertook the work of the Study with public involvement through six Local Watershed Committees. Following is a summary of the conclusions of each technical committee.

Drainage and Flood Control

The hydrologic impacts of land use and land cover changes on the runoff regime in the Basin were assessed. The application of the mathematical Simple Lumped Reservoir Parametric (SLURP) model was used to simulate the current land cover data for 1995-1997 at five locations within the Basin. Streamflow records were also examined to determine if changes in runoff resulting from changing land cover and land management practices could be detected. Literature on the effects of land cover changes and agricultural practices were reviewed with application to the Basin.

Conclusions:

- Climatic processes dominate the generation of major flood events.
- The greatest impact of drainage of wetlands is during moderate runoff events, with the effect diminishing for increasingly larger flood events.
- Drainage of wetlands has little effect on major flood events.
- Effects of land cover changes and wetland drainage in the Basin could not be quantified, but a trend of increasing runoff volume was detected.
- Increased runoff volumes into lakes give rise to management problems and reduces operational flexibility of reservoirs.

Wetlands

Wildlife use of wetlands and uplands was described following a literature review. The distribution and extent of wetlands and uplands were estimated. The abundance of wetlands, waterfowl populations and the effects of cyclic precipitation and land use practices on wetlands and native uplands were described. Social and economic considerations related to wetland and native uplands were discussed.

Conclusions:

- Temporary and seasonal wetlands are the most common types in the Basin. They are as important for wildlife breeding and foraging as more permanent wetlands.
- In some areas, an average of 45 per cent of the wetland area has been removed. Temporary and seasonal wetlands are most impacted by agricultural activities. In some areas, up to 75 per cent of the temporary wetlands and up to 80 per cent of their margins were cultivated.

- Wetlands and native uplands provide a source of domestic water, livestock watering and forage, recreational activities, and non-consumptive uses such as hunting, trapping, fishing and eco-tourism.
- Wetlands help to control erosion, and also recycle, immobilize and concentrate nutrients.
- Producers see wetlands as an additional liability because no financial incentive is provided to them to retain the wetlands for conservation benefits.

Water Supply and Use

The surface water and groundwater supplies in the Basin were examined. The state of surface water supply and the major water uses were evaluated on a mean monthly basis using a simple water management model. This involved comparing current and future water requirements for both consumptive and instream users with available supplies.

Conclusions:

- At both the current and future level of water use, surface water supply is generally sufficient, although it is less reliable in the headwaters of the Basin. As with all prairie areas, the Basin is subject to droughts.
- The preliminary analysis suggests that sufficient water is available for instream flow needs (aquatic ecosystems) and offstream uses, but during periods of low flows there may be conflicts over water use.
- Apportionment between Saskatchewan and Manitoba is not an issue in the Basin at the present time or in the foreseeable future.
- There is no reliable method to determine the effect of drainage or climate change on the supply and use relationship.
- No aquifer management plans other than one currently being developed for the Yorkton aquifer system are contemplated, although additional developments may make them necessary.

Water Quality

A literature review was commissioned on the effects of agricultural drainage, livestock and range management practices, and municipal lagoon releases on surface water and groundwater quality and protection. Available water quality data were examined for long-term trends and suitability for most expected uses. The impacts of livestock management practices were addressed.

Conclusions:

- In general the water quality is suitable for its expected uses. There are areas where limitations to such uses as irrigation are evident. It is important to note that in some cases the assessment is based on a limited quantity of data.

- Some of the impacts of agricultural land drainage on water quality include nutrient loading, pesticide contamination, heavy metal contamination, erosion and sedimentation. As well, water quality benefits accrued by wetland retention are lost when wetlands are drained.
- Key points that could be targeted for the agricultural industry include the proper handling and application of farm chemicals, appropriate methods and locations for cleaning sprayers and empty containers and use of container disposal sites. Testing for the effects from hazardous substances in landfills, container collection sites, and discontinued bulk fuel depots and gas stations is also important. The industry should also look at the development of Best Management Practices for annual cropping and livestock management.
- Proper decommissioning of abandoned wells, proper maintenance of existing wells and proper siting and construction of new wells are all factors to be considered in protecting water quality.
- There is little integrated database management among the variety of agencies collecting data. As a result, much of the information regarding groundwater availability and quality is lacking continuity and can be difficult to obtain.
- Without long-term monitoring, it will be impossible to adequately protect the Basin's groundwater since changes will not be detected until contamination is widespread.

Recommendations

Watershed Management

1. Watershed plans should be developed with local involvement as a basis for land and water management, development and conservation. One or more pilot projects to undertake watershed planning should be initiated as soon as possible.

2. Proposed drainage projects should be planned and approved within the context of a local watershed plan which considers the impacts at downstream locations. The plan should include operating guidelines for controlled drainage works and backflood projects so that downstream damages are minimized.

3. Measures should be taken to ensure the availability of adequate supplies of good quality water in all areas of the Basin. In particular, the expected expansion in livestock production will require a dependable supply of good quality water.

4. Instream flow needs for maintenance of aquatic habitat and fisheries should be an integral part of future water management, particularly when changing the operating guidelines for a dam and when granting new water allocations.

5. Water quality should be taken into consideration when evaluating drainage projects. Criteria should be established for rating or evaluating drainage projects. A code of practice should be developed for construction of drainage projects to reduce impacts on water quality. The cumulative impacts of drainage on water quality should be considered in the context of a watershed plan.

Best Management Practices

6. Where drainage projects are approved, the construction of works such as backflood projects or controlled drainage should be promoted to minimize adverse downstream effects.

7. Best Management Practices for agriculture and other industries should be developed and promoted with emphasis on surface water and groundwater protection.

8. Agricultural practices such as conservation tillage and permanent cover programs which retain or re-establish perennial cover should be promoted as means to reduce runoff rates and volumes.

9. The livestock industry should be encouraged to improve riparian areas through alternative pasturing, livestock watering systems, and properly located and managed winter feeding sites.

10. Maintenance of natural vegetation cover around water bodies should be encouraged. Licensing preference should be given to drainage works that include establishment of vegetation cover such as grasses to protect drainage channels from erosion. Buffer strips or bush adjacent to water courses or water bodies should be protected to reduce the potential for erosion or contamination of the receiving water body.

11. Wells should be properly sited, constructed, maintained and decommissioned to protect groundwater from contamination.

Policy, Legislation and Enforcement

12. A planning and approval process should be developed to support landowners and government resource management agencies in determining appropriate levels of development.

13. An effective regulatory framework for drainage should be established which takes into account the resources and expertise required for proper review and enforcement.

14. Provincial and local governments should ensure that additional development does not occur within flood prone areas through a review of the processes for subdivision approvals and granting of building permits.

15. Economic and other factors faced by producers in their decision whether or not to drain wetlands should be considered in the development of environmental, social, or economic programs or policies to address drainage issues.

16. Regulations should be reviewed that apply to the construction and monitoring of facilities such as landfills, lagoons, chemical storage and pesticide container disposal sites. (Saskatchewan)

17. Agencies responsible for surface water and groundwater management and protection should be encouraged to develop a joint database of the current status of water quality.

Education and Demonstration

18. Water management agencies should expand efforts to promote awareness of the hydrologic processes that lead to floods, especially large floods, as well as the effect of water control projects on flow rates and water levels.

19. Information should be provided on the value and proper application of manure as a nutrient-rich fertilizer.

20. Education activities should be implemented to caution pesticide users to avoid cleaning sprayers and chemical containers near open water, to apply product at the proper rates and to follow label restrictions and recommended practices.

21. A public education program on proper well and aquifer management should be initiated to protect groundwater formations from contamination.

22. Agencies should provide coordinated and effective communication to the public and stakeholders on land management issues that affect surface water and groundwater.

23. Information and extension programs should be developed to increase awareness of the importance of wildlife habitat (wetlands, uplands and riparian areas) in the Basin as well as the opportunities to implement land use activities that will benefit both agriculture and wildlife.

Research and Studies

24. Water and wetland management agencies should:

- develop criteria to assist landowners in planning, and resource managers to identify, wetland and upland habitat that requires protection;
- collect further data for very small, shallow wetlands to provide greater confidence in applying the area/volume relationship in the range of wetlands subject to contour ditching and V-ditching;
- develop instream flow guidelines;
- investigate structural and non-structural means to improve operational flexibility of the reservoirs;
- undertake aquifer characterization including aquifer production capabilities and water quality analysis to define the groundwater supply and facilitate economic development;
- develop aquifer maps to define various aquifers in the region with an emphasis on unconfined or vulnerable aquifers;
- determine any long-term effects of lagoons on receiving water bodies through more extensive studies and monitoring; and
- review the required quality of wastewater effluent and the procedures for its release to receiving waters.

25. Research agencies should:

- develop remote sensing technology for application to the detection of wetland drainage;
- continue investigations into the relationship between snowmelt runoff and agricultural practices such as stubble management, conversion to permanent cover and clearing of bush;
- continue research and development of practical watershed modeling tools which can be used by provincial regulatory agencies to assess the impact of drainage projects on watershed hydrology; and
- develop watershed models with improved simulation of hydrologic processes on the Canadian Prairies such as variable contributing area and wetland storage.

Monitoring and Assessment

26. An enhanced water monitoring program should be implemented in the Basin to obtain data on actual surface water and groundwater use and to ensure that all major usage is licensed and appropriately monitored. Efforts should also be made to improve the timely analysis of data where warranted.

27. Provincial agencies should continue to monitor developments in remote sensing technology with a view to future application in the detection of wetland drainage.

28. Water and wetland management agencies should define common standards and definitions in the assembly of wetland databases.

29. An inter-agency working group should be formed to continue assessing the hydrologic effects of wetland drainage and land cover change in the Basin using the knowledge base developed in this Study.

30. Studies should be conducted to determine if engineering works are a practical method of reducing the risk of flood damages to existing developments in flood prone areas.

31. Testing of private groundwater wells should be encouraged.

32. Groundwater monitoring should be done in the vicinity of potential sources of contamination (e.g., manure storage sites, chemical collection depots, landfills, discontinued bulk fuel depots and gas stations) to determine whether contamination is occurring.

33. Long-term monitoring of surface water quality and riparian health on a watershed basis should be implemented. Monitoring should be carried out to collect information to confirm the current status of water quality and identify potential problems in the Basin.

Incentive Programs

34. Programs should be developed to encourage the retention of remaining natural wetlands to conserve habitat.

35. Programs should be developed to encourage retention of those wetlands that provide significant benefits in controlling snowmelt runoff into the stream network in most years.

36. Partnerships for the conservation of wetland and upland habitat should be pursued with non-government agencies and other interested parties.

37. Beaver management programs should be developed. Specific problem areas in the Basin should be identified. Local governments and resource management agencies should work together to target management efforts.

38. Programs should be developed to encourage the adoption of compatible land use practices in flood prone areas in order to reduce damages to agricultural lands and urban developments located adjacent to streams and water bodies.

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Many individuals and organizations have made valuable contributions to the Upper Assiniboine River Basin Study. The Management Committee would like to specifically thank the following individuals and agencies for their assistance.

- Local Watershed Committee members for their ideas, discussion and critical comment.

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- National Water Research Institute (NWRI), Saskatoon, research scientists Al Pietroniro, John Pomeroy, and Raoul Granger for advice on application of the SLURP model; Tom Brown, consultant to NWRI, for modifications to the SLURP coding; Ron Hopkinson, Environment Canada, for compiling the meteorologic data used in the model.

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Glossary

Best Management Practices (BMPs) - voluntary guidelines that encourage producers to use management practices that work to protect the environment.

Carbon Offset - a mechanism by which the impact of emitting a ton of carbon dioxide (CO_2) can be negated or diminished by avoiding the release of a ton elsewhere, or absorbing a ton of CO_2 from the air that otherwise would have remained in the atmosphere. It can be helpful to differentiate between an emissions reduction and a carbon offset. Demand side management efforts pursued inside a utility's service territory, for example, would constitute an emission reduction. Efforts pursued outside a utility's service territory, whether domestically or internationally, would be categorized as CO_2 offsets since the impacts of the project would not show up in the utility's emission statistics.

Carbon Sequestration - a flow of carbon by which it is absorbed or taken out of the atmosphere and stored in a terrestrial or oceanic reservoir. This differs from the preservation of existing carbon stocks in a reservoir.

Code of Practice - minimum rules that must be followed in developing a project.

Conservation Tillage - any tillage sequence in which the object is to minimize or reduce loss of soil and water. Operationally, it is any tillage and seeding sequence which leaves more than 30 per cent of crop residue on the soil surface.

Cultivated Land - land that is tilled and used for annual cropping.

Drainage - movement of water off of land. Drainage may be natural or man-made.

Ecosystem - a community of organisms interacting with one another and with the chemical and physical factors making up their environment. The chemical and physical factors include sunlight, rainfall, soil nutrients, climate, salinity, etc. Energy and nutrients may move in and out of an ecosystem. Individual organisms (such as seeds, spiders, and sparrows) may also move in and out of an ecosystem.

Some considerations based on this definition are:

- all parts of the planet, from a microbe drifting in the upper atmosphere, to the wheat midge egg in the soil and the tadpole in the slough, are within an ecosystem. An ecosystem has no defined size.
- ecosystems are not necessarily stable, nor are all their component species necessarily native to the area. Purple loosestrife is an example on an intruder that now can be a member of a given ecosystem.

- ecosystems are difficult to separate from each other. Boundaries may be drawn to study a specific species, but the boundary is arbitrary.
- based on the definition now used by ecologists, an ecosystem can be large or small and can include both pristine and highly developed areas.

Geographic Information System (GIS) - a computer system for collecting, storing, manipulating, analyzing and presenting spatial and non-spatial data.

Instream Flow Needs (IFN) - the amount and seasonal timing of flowing water in a stream required to sustain aquatic organisms and processes.

Intensive Livestock Operation (ILO) - the confining of any of the following animals, where the space per animal unit is less than 370 square metres: poultry, hogs, sheep, goats, cattle, horses, elk, mule deer, white-tail deer, fallow deer, bison, or any other prescribed animals.

LANDSAT - a Canadian satellite that collects data in multiple wavelengths including visible and infrared. The data collected by LANDSAT are particularly useful in determining land cover types.

Manure Containment - an earthen manure storage (EMS) is the term associated with the storage of liquid manure in an earthen structure. An EMS is strictly a storage unit and is not designed for "treatment" of the waste as is expected of municipal lagoons. As a rule, an EMS is three to five metres deep. Within the Basin, EMSs are used primarily for the storage of liquid hog manure. There is limited use of EMSs for storage of liquid dairy and poultry manure. Manitoba suggests that an EMS should have a minimum 200 days of storage; Saskatchewan requests 400 days of storage for all new EMS structures. Both provinces require the involvement of professional engineers in the design of an EMS.

Minimum Tillage - the minimum use of primary and/or secondary tillage necessary for meeting crop production requirements under the existing soil and climatic conditions, usually resulting in fewer tillage operations than normally used in conventional tillage.

No-Till or Zero Till - a procedure whereby a crop is planted directly into the soil with no primary or secondary tillage since the harvest of the last crop; usually a special seeding machine is required to prepare a narrow, shallow seedbed immediately around the seed.

Pesticide - any chemical used to control pests such as weeds (herbicides), insects (insecticides), crop diseases (fungicides), and rodents (rodenticides). In general, insecticides are more toxic than herbicides. Organophosphorous insecticides are more toxic than carbamates and organochlorine insecticides.

Riparian Area - the transition zones between land and water environments. They are the narrow strips of land located along streams, lakes, potholes, springs, coulees, and wooded draws - anywhere that water is plentiful. Riparian area boundaries can normally be identified from the surrounding uplands by an increased abundance of water and by plant communities that are different from those of the drier uplands.

Reduced Tillage - a tillage system in which the total number of tillage operations used for seedbed preparation is reduced from that normally used on that particular field or soil.

Watershed - the entire region or basin that drains into a river, lake or reservoir; the basin or series of watersheds upstream of a given point on a stream that contribute to the flow at that point (the definition used for defining the Study boundary); the topographic ridge or dividing line from which surface water flows in two different directions. Except where two watersheds are separated by very flat areas, it is relatively easy to define watershed boundaries.

Units of Measurement

Unit	Abbreviation	Imperial Conversion
millimetre	**mm**	**0.04 inches**
centimetre	cm	0.39 inches
metre	**m**	**3.28 feet**
cubic metres per second	m^3/s	35.32 cubic feet per second
cubic decametre	**dam^3**	**0.81 acre feet**
kilometre	km	0.62 miles
hectare	**ha**	**2.47 acres**

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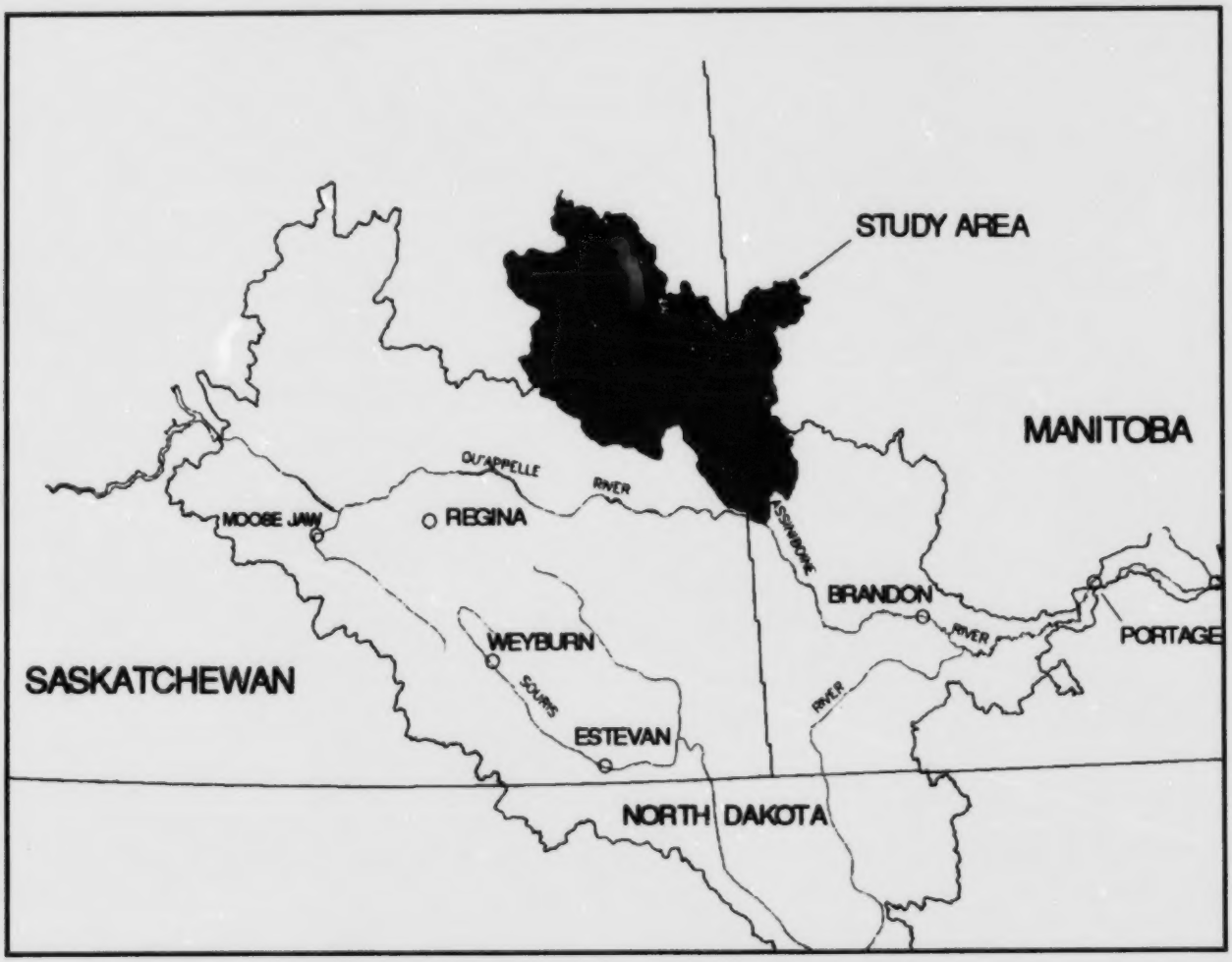


Figure 1.1 - Study Area Map

1.0 Introduction

1.1 The Need for a Study

In October 1996, the governments of Saskatchewan, Manitoba and Canada signed a formal agreement to undertake a study of the upper portion of the Assiniboine River Basin (Figure 1.1). The need for a study was considered a priority by Manitoba and Saskatchewan because of the 1995 flood, the diversity and persistence of water and water-related resource issues, including drainage and flood control, and the concern over the disappearance of valuable wetland habitat. In addition, there was uncertainty regarding water supplies required for sustainable development for municipal, industrial, agricultural and recreational purposes. There was a lack of knowledge regarding the hydrologic and ecological processes and their effects at work within the Basin. There was also a growing concern that the quality of water in the Basin was deteriorating, combined with an uncertainty about appropriate measures for aquifer management and protection. A study would provide an understanding of the Basin's water resources and develop information and recommendations on which to base decisions affecting future water management.

Water issues in the Upper Assiniboine River Basin pre-date the Study. The Prairie Provinces Water Board (PPWB), with representation from Canada, Alberta, Saskatchewan and Manitoba, is responsible for overseeing the 1969 Master Agreement on Apportionment. In addition to ensuring the equitable sharing and protection of interprovincial waters, an important responsibility of the Board is to help prevent or resolve interprovincial water issues.

In the late 1970s, the Board discussed the effects of agricultural drainage and road construction on natural flows on the Assiniboine River at the Saskatchewan-Manitoba boundary. The Board recognized that there were, at that time, no adequate technical means of determining the effects of drainage, and consequently asked its Committee on Hydrology to develop an applied research program which might lead to a procedure to assess the effects of artificial drainage on downstream flows of Prairie streams. The Board accepted the Committee's recommendation to use a simple contributing drainage area technique as an interim measure, and to monitor on-going research by other agencies in both Canada and the United States which was expected to lead to a better understanding of the issue and improved analytical methods. This research has not resulted in the expected development of practical watershed modeling tools which can be used to assess the impact of drainage on downstream flows.

The impact of drainage on downstream watersheds was the focus of considerable discussion by the Board in the early 1980s. The Board recognized the complex nature of determining a hydrological methodology suitable for evaluating the downstream effect of drainage activity. The Board stressed the need for negotiations between provinces and the need to consider a methodology that would resolve historic concerns and deal with future drainage.

1995 Flood

Two matters eventually led Saskatchewan, Manitoba and Canada to agree to undertake a study of the Upper Assiniboine River Basin. There is a long-standing desire locally for direction on how to address the unresolved persistent water management issues centered on drainage concerns. The spring flood event in 1995 and attendant large costs to communities, landowners, and governments proved to be the catalyst to hasten the onset of the Study.

1.2 Scope of the Study

The agreement enabled the governments of Saskatchewan, Manitoba and Canada to conduct a three-year study to assess the Upper Assiniboine River Basin's water resources and examine the possible impact of current and future development activity. Since all aspects of water management and related land uses must be considered when decisions affecting the resource are made, the Study was designed to develop key information upon which future decisions can be based. Public involvement was a vital component of the investigation.

The Study term was extended from October 1999 to June 30, 2000, and eventually to December 31, 2000. Additional time was required to resolve unforeseen technical problems in calibrating the hydrologic model to make it reflect the 1990s conditions of the Basin. Technical committee work had taken longer than expected because agencies participating in the Study were affected by other commitments. Furthermore, local participants were keen to have ample opportunity to review the Study recommendations.

1.3 Study Objectives

A set of objectives was developed based on the requirement of governments to carry out their mandates in water resource management, with a focus on the issues and problems that are prevalent in the Study area. To ensure that the Study was able to address as many current and future situations as possible, a thorough issues identification process began in 1996. Meetings were held with approximately 40 municipal councils in the early part of the year, followed by a series of open house meetings to provide an opportunity for Basin residents to discuss water management issues. Approximately 275 people attended these open houses.

Predominant issues centered on drainage/flooding/wetland habitat, although other concerns were often expressed including beaver control, channel clearing, water quality protection, groundwater concerns and water supply issues. The work of six Local Watershed Committees confirmed the importance of the identified issues.

The Study established the following objectives:

- document current and emerging water and related issues;
- develop a thorough understanding of the surface water and groundwater supplies, ranging from floods to droughts, and to develop an understanding of existing and future water supply needs;
- assess the impacts of land use changes and drainage activities on the Basin's water and related resources;
- ensure that the people who live in the Basin are fully aware of, and have input into, Study activities and understand the relationships between land and water management in the Basin;
- assess the quality of the Basin's water resources and identify the effects of various activities on water quality; and
- develop a framework plan that addresses the implications of future water supply and water demandscenarios.

1.4 Study Organization

Saskatchewan and Manitoba appointed co-directors to guide the Study. In addition, several committees were established. Committee members are listed at the end of this report. Figure 1.2 illustrates the organizational structure.

1.4.1 Local Watershed Committees

The wide variety of water management issues, the deeply rooted views held by many of the Basin residents, and the immediacy of the problems reinforced the importance of ensuring public awareness and participation was fully integrated within the Study process. This was achieved through the formation of six Local Watershed Committees made up of stakeholders with local water resource interests in each of the sub-basin planning units. These regional groups were more conducive to local participation due to reduced travel distances. They also provided a greater focus for local issues.

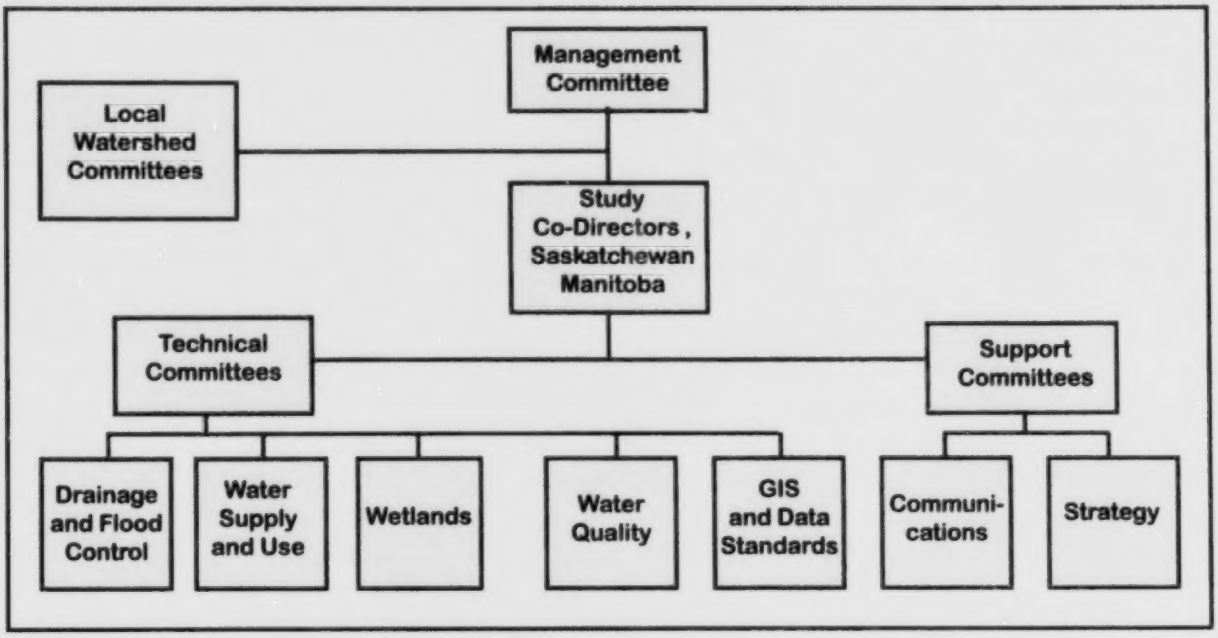
Representatives of local rural and urban governments, regional watershed or development associations, wildlife and recreation groups, and other interested area residents comprised these committees. The committees provided input to Study activities and communicated with area residents about Study progress and results.

The sub-basin watersheds represented by Local Watershed Committees were (Figure 1.3):

- Lower Assiniboine;
- Upper Assiniboine;
- Lake of the Prairies;
- Lower Whitesand;
- Upper Whitesand; and
- Yorkton Creek.

The Study provided local participants with information to assist them in responding effectively to water management strategies. This included seven open house meetings, 17 meetings for each Local Watershed Committee, a tour of the Basin, four workshops, 56 background papers and 18 information presentations. The Public Involvement Report, Appendix F, provides an overview of these activities.

Figure 1.2: Study Organization Chart



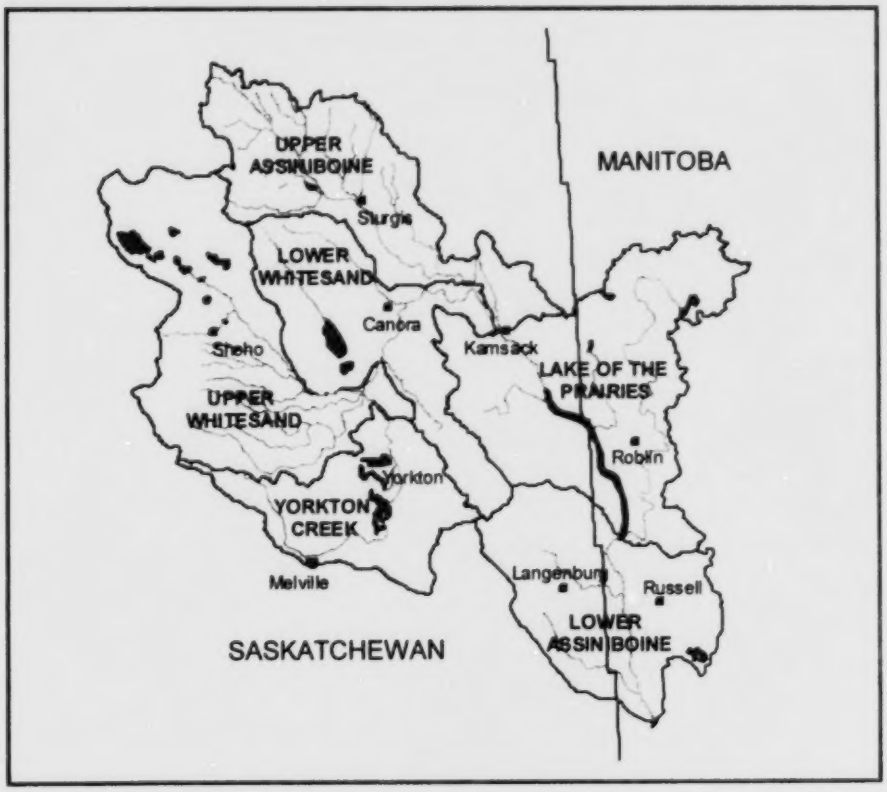


Figure 1.3: Local Watershed Boundaries

1.4.2 Management Committee

Representatives of Sask Water, Saskatchewan Environment and Resource Management, Saskatchewan Municipal Affairs, Culture and Housing, Manitoba Conservation (formerly Manitoba Natural Resources), Manitoba Conservation (formerly Manitoba Environment), Manitoba Intergovernmental Affairs, Environment Canada and the Prairie Farm Rehabilitation Administration comprised this Committee. It assumed responsibility for all aspects of the Study, including establishing goals and principles, developing the Study terms of reference and ensuring there was sufficient stakeholder involvement in all components of the investigation.

1.4.3 Technical Committees

The Management Committee appointed technical committees with the responsibility to undertake or direct the technical activities of the Study. These committees represented both government and non-government resource management interests from Saskatchewan, Manitoba and federal agencies.

Drainage and Flood Control Committee

The Drainage and Flood Control Committee was charged with determining the extent that the Basin landscape has changed because of wetland drainage and the clearing of bush and breaking of grasslands, and evaluating the impacts of these changes on the surface water regime. The Committee's terms of reference were to:

- determine and quantify changes in land cover and depressional storage;
- evaluate the impacts of land use/cover changes on the Basin's hydrology; and
- investigate other flooding issues which may be identified.

The Committee's work involved the development of models and tools and acquisition of databases to quantify and assess the hydrologic impacts of land use/ land cover changes within the Basin. The Committee also supported the other committees in the Study by providing hydrological expertise, technical support and information as required.

Water Supply and Use Committee

The Water Supply and Use Committee examined surface water and groundwater supplies in the Basin. This involved comparing current and future water requirements for both consumptive and instream uses with available supplies.

Terms of reference and a work plan were developed to address issues relating to water supply and use within the resources available to the Study. The main objectives were to examine the:

- present and future water supply;
- present and future water use; and
- state of water supply versus use for present and future needs.

Factors which may affect the state of water supply and use in the Basin, such as the effect of drainage on water supply and the potential effect of global warming on both supply and use, were also considered.

Wetlands Committee

Agencies with an interest in wetland resource management were invited to form the Wetlands Committee. The primary purpose of the Committee was to provide information relevant to wetland management in the Basin. The objectives were to:

- describe the wetland resources;
- describe how wetland resources have changed over time;
- describe the uses and the economic values of wetlands in the Basin;
- develop wetland management objectives; and
- develop strategies for achieving these objectives.

The Committee gathered, synthesized and analyzed information on land cover and wetlands and contracted a literature review on wildlife and wildlife habitat.

Water Quality Committee

The Water Quality Committee's focus was to assess the quality of the Basin's water resources and identify the effects of various activities on water quality. The main water quality issues identified and addressed were:

- the effects of agricultural drainage on water quality;
- nutrient enrichment of water bodies from municipal effluent;
- nutrient enrichment from livestock access to watercourses;
- trends in water quality; and
- the protection of groundwater from contamination.

The Water Quality Committee commissioned a literature review on the effects of agricultural drainage, livestock and range management practices, and municipal lagoon releases on surface water and groundwater quality and protection. Available water quality data were examined for long-term trends and suitability for most expected uses. The impacts of livestock management practices were addressed. The Committee also participated in several projects that demonstrated good practices for managing livestock near water bodies.

Geographic Information System and Data Standards Committee

This Committee had four main responsibilities within its Study advisory role:

- create data standards for the information generated and used in the Study, with consideration to existing and future data uses;
- recommend standards for datums and data projections, Geographic Information Systems (GIS), imagery and graphics;
- assist in the selection of criteria for spatial data to be collected using a tendering process; and
- advise on technical data issues.

The GIS Data and Standards Committee managed two contracts on behalf of the Study - a contract for satellite imagery from Ducks Unlimited Canada, and a contract for scanned historic National Topographic Survey data from a private contractor. Recommendations to resolve technical problems were provided upon request and included topics such as cost estimates for data acquisition, data storage and processing, data licensing, and data distribution.

The Committee promoted GIS and informed both public and Study participants in GIS/spatial data and analysis.

1.4.4 Support Committees

Communications Committee

The Communications Committee integrated public involvement with Study activities. In addition, it produced information updates and made the public aware of Study activities within the Basin.

Strategy Committee

The Strategy Committee, in consultation with the technical committees, Local Watershed Committees and Management Committee, developed options for solutions to the identified issues and concerns.

The issues and concerns identified by the Local Watershed Committees and resource managers were compiled. Lists of the policies, programs, legislation, regulations, agencies and organizations affecting water management were compiled to describe the existing water management framework. Basin management objectives were identified and proposed strategies were prepared to address the issues. These strategies, based on the knowledge, tools and databases developed, were reviewed by the Management Committee and presented to the Local Watershed Committees.

Upper reaches of the Assiniboine River

1.5 Moratorium on Drainage

With the initiation of the Study, a moratorium was placed on the approval of drainage development projects which could potentially add volume and contribute to peak flow and flow duration in the Assiniboine River. This was intended to maintain constant conditions throughout the Basin during the Study period and avoid compounding existing issues.

The moratorium called for a suspension of all regulatory approvals and provincial and technical assistance associated with drainage development in the Upper Assiniboine River Basin. As part of the moratorium, Sask Water and Manitoba Conservation (Water Resources Branch) investigated drainage activity in the Basin which had been reported in writing and had taken place during the moratorium. Works determined to have been constructed after the start of the moratorium were ordered closed in accordance with the provisions of the respective agency's legislation. Investigation of works were prioritized on the basis of the apparent impact of the works. The moratorium on drainage projects in the Basin continued to June 30, 2000. After that date, interim guidelines were put in place until the Study's recommendations could be reviewed by the appropriate agencies.

The moratorium did not affect:

- channel clearing to remove trees, shrubs, beaver dams, blow dirt and other obstructions from natural channels and water courses (Saskatchewan);
- normal channel maintenance (Manitoba) ;
- projects which received approval prior to the moratorium and which were in progress;
- maintenance work for existing projects approved by Sask Water or constructed prior to 1981 (Sakatchewan);
- slough consolidation by landowners for internal drainage where the water would not exit the owner's land (Saskatchewan);
- activities to control soil erosion works, if water was not diverted from the normal outlet and the downstream volumes and peaks were not increased; and
- drainage works undertaken for extra special circumstances which could be submitted to Sask Water and Manitoba Water Resources Branch for approval and which would be subject to the normal environmental and regulatory processes of the respective province

2.0 Basin Characteristics

2.1 Physical Characteristics

The Assiniboine River and its tributaries drain areas in eastern Saskatchewan and western Manitoba. The major tributaries include the Qu'Appelle River, which joins the Assiniboine at St. Lazare, Manitoba and the Souris River, which joins east of Brandon, Manitoba. The Assiniboine River terminates at the Red River in Winnipeg. The focus of this Study is the upper portion of the Assiniboine River Basin from its headwaters to its junction with the Qu'Appelle River (Figure 1.1).

The headwaters of the Assiniboine River are about 50 kilometres (km) northwest of Preeceville in the Porcupine Hills. The Whitesand River, which rises out of the Beaver Hills northwest of Yorkton, joins the Assiniboine River near Kamsack. The Assiniboine River then continues southeast for another 45 km before entering Manitoba. Other major tributaries are the Shell River, Lilian River and Yorkton Creek. Several natural lakes are found in the Basin, most notable of which are Good Spirit Lake, Fishing Lake, and the series of small, interconnected lakes south of Yorkton, which include York, Roussay, Leech, and Crescent lakes. Lake of the Prairies, formed by the Shellmouth Dam, is the largest lake in the Basin. The Basin's major lakes and streams are shown on Figure 2.1.

The Basin encompasses about 21,000 square kilometres, with 79 per cent in Saskatchewan and 21 per cent in Manitoba.

The Basin encompasses about 21,000 km^2, with 79 per cent in Saskatchewan and 21 per cent in Manitoba. It is situated within two major physiographic regions — the Saskatchewan Plains and the Saskatchewan Uplands. The former is comprised of the Assiniboine River Plain and the Quill Lake Plain physiographic units; the latter is represented by the Duck Mountain Upland, the Porcupine Hills Upland and the Touchwood Hills Upland. The topography is gently to moderately undulating with the higher relief evident in the northeast portion of the Basin. Surficial sediments are primarily glacial till that is deeply incised by spillways and meltwater channels. Most of the area is underlain by Cretaceous shales of the Riding Mountain Formation up to 300 metres (m) thick.

The northern headwater reaches of the Basin lie within the Boreal Plains Ecozone, an area characterized by groves of brush, wooded bluffs, steeper flow gradients and reasonably well defined drainage patterns. To the south, the lower and largest portion of the Study area falls within the Prairie Ecozone, a much flatter terrain with less brush and fewer trees. During the retreat of the most recent glacier, some 10,000 years ago, a condition known as ablation moraine or dead-ice moraine predominated in this area of the Prairie resulting in a hummocky landscape, an area pock-marked with a myriad of dimpled depressions, sloughs and potholes.

Black chernozemic soils overlay almost 70 per cent of the Basin. These soils are high in organic matter and have generally developed under native grassland vegetation. In the northern and southwestern portions of the Basin, the black soils have been modified to dark grey and grey chernozemic and luvisolic soils. Regosolic soils generally occur in river valleys and adjacent to Basin lakes. These soils are light-coloured, lack distinct horizons and are highly fertile as a result of alluvial deposition during periodic flood events. The original natural vegetation of the area was native grassland interspersed with groves of aspen or occasionally oak. Most of the grasslands have been cultivated but many of the aspen groves remain.

Figure 2.1: Upper Assiniboine River Basin

The climate of the Basin is continental sub-humid characterized by long, cold winters and short, warm summers. The frost-free season varies from 90 to 110 days, and the annual precipitation averages about 450 millimetres (mm) of which 27 per cent is snow. Annual precipitation exhibits wide variations. For the period 1961-1990, annual precipitation at Yorkton varied from a low of 140 mm in 1961 to a high of 550 mm in 1981. The lowest amount of snowfall recorded was in 1981-82 with 42 centimetres (cm) and the maximum snowfall recorded occurred in 1965-66 with 217 cm. Most of the moisture is provided by air masses originating near the Gulf of Mexico. Convection activity in these air masses during the summer months regularly contributes to significant rainfall amounts.

2.2 Fish and Wildlife

The Basin supports a diverse wildlife population. White-tailed deer are the most common ungulate, inhabiting the hills, valleys and aspen bluffs. Elk and moose are less common. Other types of wildlife commonly found include bear, muskrat, beaver, skunk, badger and gopher. Waterfowl and upland game are widespread. The Basin is situated in the prime North American nesting and breeding area for ducks and geese. Habitat in the pothole region in the western areas is particularly good for waterfowl. Ruffed and sharp-tailed grouse are also common.

Included in the area's diverse bird population are endangered species identified by the Committee on the Status of Endangered Wildlife in Canada, an independent body with provincial and federal government representation. The organization has identified the loggerhead shrike, burrowing owl, Baird's sparrow and ferruginous hawk as threatened species, all of which are residents of the Study area.

Few water bodies within the Basin have an adequate capability to support fish habitat. The native species, primarily northern pike and yellow perch, are supplemented through stocking programs.

Few water bodies within the Basin have an adequate capability to support fish habitat. The native species, primarily northern pike and yellow perch, are supplemented through stocking programs. Northern pike, yellow perch, walleye, mooneyes, carp, white sucker, silver and northern redhorse, blacknose dace, brook stickleback, chestnut lamprey, emerald and spottail shiner and blackside and johnny darter are found in the Assiniboine River, the major tributaries and Lake of the Prairies. This lake is likely the most popular angling area in the Basin.

2.3 Land Use

When the first European fur traders began exploring this Basin in the mid-eighteenth century they encountered extensive grasslands with a scattering of wetlands and aspen bluffs. The Touchwood Hills in the western portion of the Basin were vegetated by large tracts of aspen. The Boreal area in the north had mixed-wood forests of spruce, aspen and birch. The Basin was first used for fur production about 1790 with the establishment of trading forts.

European settlement and the subsequent conversion of grasslands to cultivation began around 1880 and accelerated through the early twentieth century. Historical accounts speak of very few trees in the Basin at the time of settlement. The aspen bluffs presently located throughout areas of intense agriculture are said to be the result of the absence of the earlier, wide-scale prairie fires.

The purpose for settling the Prairies was for agricultural development. Under the Homesteads Act, an individual could gain ownership of a quarter section of land by living on that quarter and by breaking it for crop production.

Land use changes took place in the Basin as a result of the conversion to agriculture. This transition was in part the result of deliberate immigration and settlement policies, wetland policies, and agricultural programs and policies.

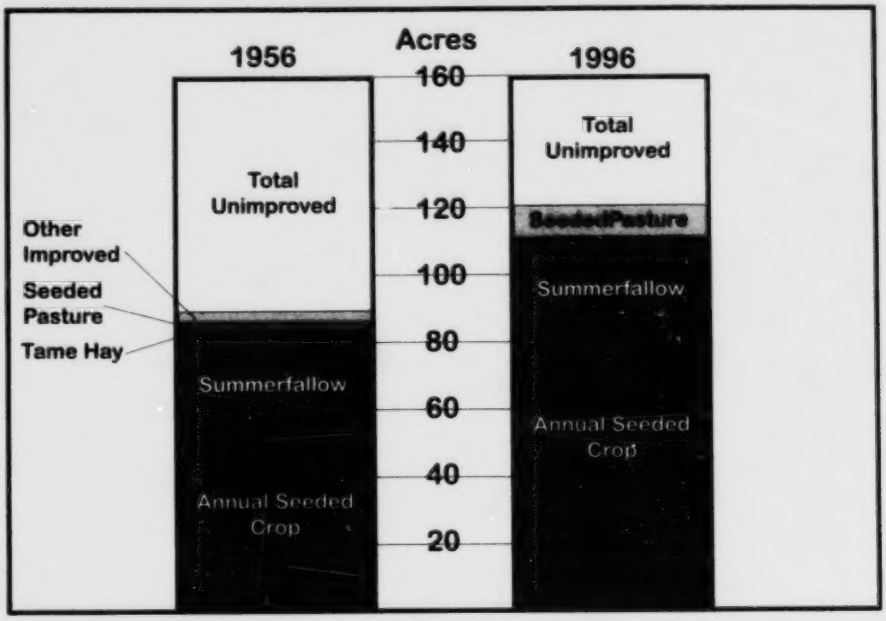
The purpose for settling the Prairies was for agricultural development. Under the Homesteads Act, an individual could gain ownership of a quarter section of land by living on that quarter and by breaking it for crop production. Even the original surveying of the Prairies, where the landscape was divided into a huge grid system of quarter sections, influenced land use. Roads were built on this grid system, often regardless of whether the road passed through a wetland, tree bluff or hilly terrain.

After the settlement of the Prairies, governments continued to encourage cultivation through their farm programs. The intent of most agricultural programs was to bolster farm income, providing financial support to producers growing grains, oilseeds and specialty crops, thereby favouring cultivation over other land uses.

While economic activity and land use are dominated by mixed grain and wheat farms, pasture and hay lands are also common. Small livestock operations can be found throughout the Study area and the development of feedlots and intensive livestock operations close to the larger communities is becoming more common. The beef cattle industry has dominated the livestock sector. However, there is increased interest in intensive hog production.

An indication of the changes in land use is provided in Figure 2.2 which compares the land use of an average quarter section in 1956 with 1996. Table 2.1 provides a summary of the types of land cover found in the Basin.

Figure 2.2: Land Use Comparison by Quarter Section, 1956 versus 1996



Industrial activity in the Basin is generally related to the larger urban centres or in the potash and petroleum sectors. Meat packing plants, dairies, concrete manufacturing, bakeries, feed mills and publishing facilities are found in the urban communities. The potash mine at Rocanville, situated immediately south of the southern extent of the Basin, is an important regional employer. The potash beds that underlay much of the region and the brick clay deposits located north of Yorkton comprise the area's mineral resources. As well, Melville forms the hub of the regional petroleum distribution network with natural gas and liquid petroleum gas storage caverns located adjacent to the community.

Table 2.1: Land Cover

Land Cover	Per cent
Cropland	58
Grass	17
Trees	14
Shrub	5
Wetland	5
Large Lakes	1

Data Source: 1990s Western Grains Transition Payment Program

Recreation is also an important part of the economy. Relief associated with rivers and lakes typically contains groves of aspen, oak and maple which enhance recreational opportunities. The Assiniboine River provides an excellent canoeing and fishing environment. Provincial and regional parks are located throughout the Basin.

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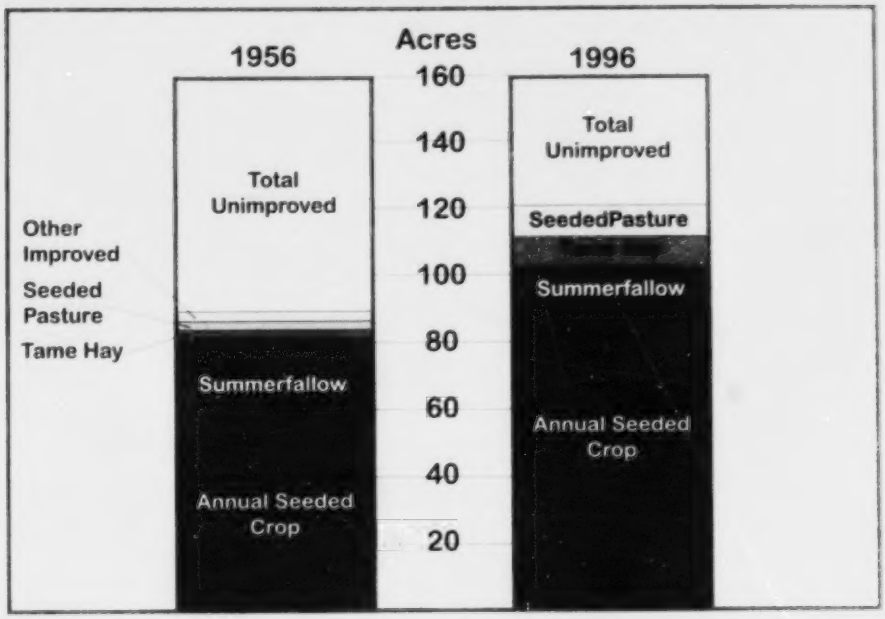

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Large Lakes	1

Data Source: 1990s Western Grains Transition Payment Program

Recreation is also an important part of the economy. Relief associated with rivers and lakes typically contains groves of aspen, oak and maple which enhance recreational opportunities. The Assiniboine River provides an excellent canoeing and fishing environment. Provincial and regional parks are located throughout the Basin.

2.4 Water Resources

About 60,000 people live in the Upper Assiniboine River Basin. The Basin supplies water to the communities of Yorkton, Melville, Canora, Kamsack, Preeceville, Roblin, and Russell, as well as to many smaller communities and individual farms. The agricultural water needs include more than 100 small scale irrigation projects and almost 200,000 head of livestock. The Basin's water also supports industry, recreation, and fish, wildlife and waterfowl habitat.

2.4.1 Surface Water Resources

Surface water supply is dominated by the Assiniboine River and its major tributaries, the Whitesand and Shell rivers (Figure 2.1). The Assiniboine originates about 50 km northwest of Preeceville. The Whitesand River, the largest tributary of the Assiniboine in Saskatchewan, originates in the western portion of the Basin about 20 km northeast of Foam Lake. The Whitesand River flows southeasterly towards Springside, easterly to the confluence with Yorkton Creek, northeasterly to the Canora area, and finally southeasterly to the confluence with the Assiniboine River near Kamsack. The Shell River originates in the Duck Mountain Upland and flows into the Lake of the Prairies upstream of Shellmouth Dam.

The surface water supply in the Basin is highly variable. Typically, water levels on the Assiniboine River peak during spring runoff and rapidly decline to a base level, which continues throughout the year. On average, the months of April and May account for 63 per cent of the annual flow, while the December through March period contributes only three per cent to the total.

Similarly, the year-to-year supply of surface water is highly variable, as was seen in the spring of 1995. The 1995 total volume of the Assiniboine River near Russell was 1,300,000 cubic decametres (dam^3) compared to the mean annual volume of about 467,000 dam^3. The historical low was recorded in 1961 (60,000 dam^3); the recorded maximum volume occurred in 1922 (1,820,000 dam^3). Peak volumes and flows are illustrated on figures 2.3 and 2.4 respectively.

Surface water supply is dominated by the Assiniboine and its major tributaries, the Whitesand and Shell rivers. The surface water supply in the Basin is highly variable.

The Basin contains a limited number of natural lakes, most of which are located in the western portion of the Study area. The largest of these is Good Spirit Lake which is situated southwest of Canora. Outflow from the lake does not occur every year and it has been subject to fluctuating levels due to varying rates of inflow and wave-induced buildup of sand at the outlet. An outlet structure was developed in 1988 which now provides some degree of lake level regulation. The Horseshoe Lake complex, a waterfowl enhancement project developed by Ducks Unlimited, is situated immediately south and downstream of Good Spirit Lake.

Figure 2.3

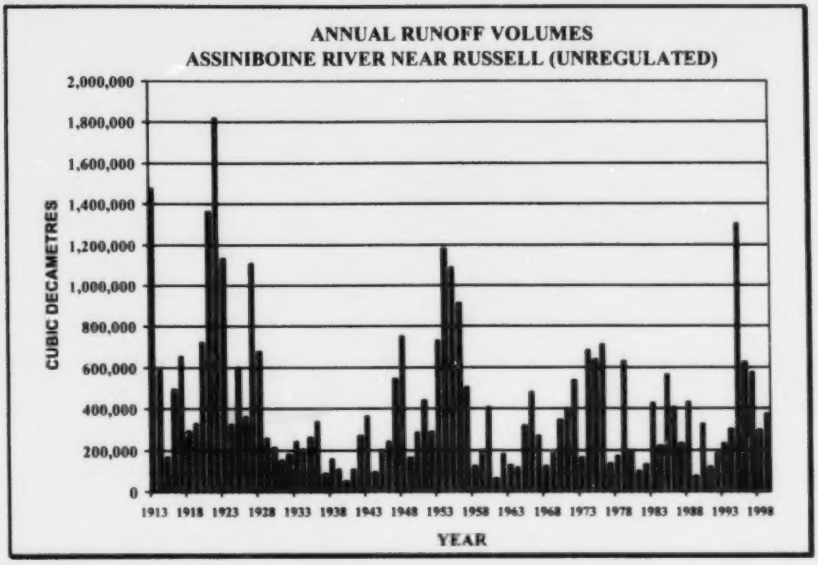
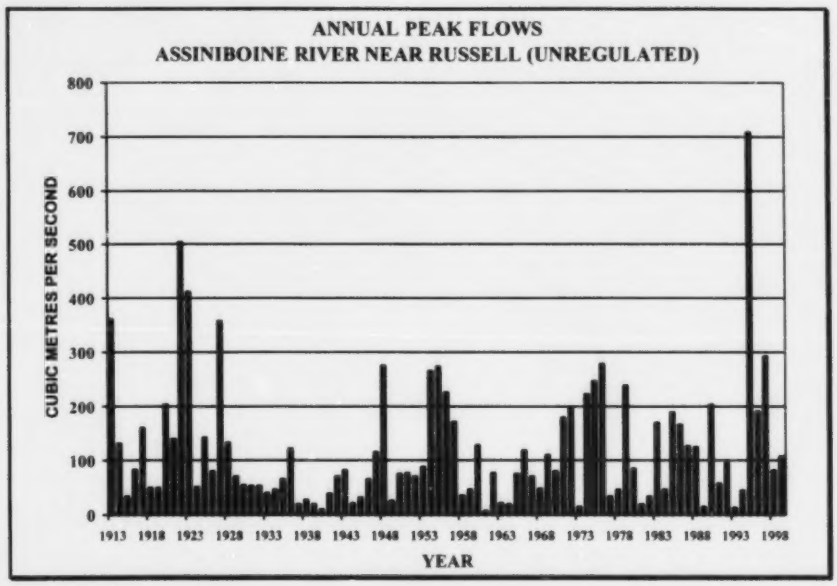


Figure 2.4



Figures 2.3 and 2.4 depict the variability of annual volumes and annual peak flows for the Assiniboine River near Russell for the years 1913 to 1999.

The lake complex south of Yorkton is also an important feature. The lakes include Upper and Lower Rousay lakes, York Lake, Leech Lake, Crescent Lake and Maddaford Marsh. A series of control structures regulate lake levels and downstream releases. The main objectives of the Yorkton South Project are flood control, stabilization of lake levels to enhance waterfowl production and recreational use, and aquifer recharge. Other important lakes include Fishing Lake and Crystal Lake.

Surface water supply can be affected substantially by drought, particularly in the headwater areas of the Basin. This highly variable and hard-to-predict water supply has led to an emphasis on water storage, since dependable year-round surface water supplies come mainly from large natural or constructed water bodies. Water storage works include dams, dugouts and natural lakes.

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The dams and reservoirs in the Basin include the Canora Weir and Theodore Reservoir on the Whitesand River, Melville Dam on Crescent Creek, Kamsack Weir on the Assiniboine River, the Yorkton South Project on Yorkton Creek and Lake of the Prairies. Lake of the Prairies is formed by the Shellmouth Dam which is situated on the Assiniboine River 35 km downstream of the interprovincial boundary.

In addition to the larger dams, the Basin contains numerous small dams providing water storage. Typically, these structures are built to store local runoff for various uses such as municipal and agricultural water supplies. Other control structures, such as those operated for Saskatchewan Environment and Resource Management and Ducks Unlimited, are generally used to maintain recreational water levels at resort sites or to provide wetland habitat.

2.4.2 Surface Water Quality

The quality of the larger sources of surface water in the Upper Assiniboine River Basin is generally acceptable for most uses. However, smaller water bodies have marginal water quality, a trait common to the prairie region. Poor water quality is often attributable to human activity, although natural conditions such as soil characteristics, can play a significant role.

Area soils are often rich in bacteria, nutrients and salts. They can work their way into water supplies over the course of the year, especially during snowmelt or as a result of groundwater contribution to surface supplies. Water quality problems are usually associated with taste and odour problems linked to algae growth in reservoirs. Nutrient inflows from municipal lagoons, livestock operations and runoff from agricultural lands are primary causes of this problem. Table 2.2 illustrates the suitability of some water bodies in the Basin for various uses.

Water quality information is very limited and inadequate to evaluate the effects of land management and other developments in the Basin.

Table 2.2: Suitability of Some Water Bodies in the Upper Assiniboine River Basin for Various Uses

Water Bodies	Recreation	Irrigation	Aquatic Life	Livestock Watering
Good Spirit Lake	√	(√)	√	√
Fishing Lake	√	X	√	X
Whitesand River*	√	(√)	√	√
Assiniboine River*	√	(√)	√	√
Shell River*	√	√	√	√
Big Boggy Creek*	√	√	√	√
Lake of the Prairies	√	√	√	√

* Using data from water quality monitoring stations upstream of known waste water discharges to represent ambient conditions.

√ Suitable

(√) Suitable with some limitations based on soil irrigated and crop grown.

X Not Suitable

2.4.2 Surface Water Quality

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Shell River*	√	√	√	√
Big Boggy Creek*	√	√	√	√
Lake of the Prairies	√	√	√	√

* Using data from water quality monitoring stations upstream of known waste water discharges to represent ambient conditions.

√ Suitable

(√) Suitable with some limitations based on soil irrigated and crop grown.

X Not Suitable

2.4.3 Groundwater Resources

In contrast to surface water, the groundwater supply in the Basin is much more stable although typically less able to provide large quantities of water at any one location. The groundwater is contained in two general aquifer types; the Tertiary-Quaternary bedrock aquifers and the intertill aquifers. Bedrock aquifers tend to be of reasonably high yield, and are insulated from surface drought conditions.

The Hatfield Valley aquifer system is a major source of groundwater. It consists of a series of inter-connected aquifers located in the southern portion of the Basin, including the Bredenbury, Wynyard-Melville, Willowbrook and Hatfield Valley components. Of these, the Bredenbury aquifer underlies the largest portion of the Study area (3,300 km^2). It is comprised of the Bredenbury Formation sands and silts which extend from the Yorkton area in a southeasterly direction. The aquifer thickness averages about 25 m. The aquifer is hydraulically connected to the Hatfield Valley and Melville aquifers, and possibly to the course-grained glacial deposits around the cities of Yorkton and Melville.

In contrast to the surface water resource, the groundwater supply in the Basin is much more stable although typically less able to provide large quantities of water at any one location.

The net annual yield of the Bredenbury aquifer, based on precipitation recharge, has been estimated at between 35,000 and 58,000 dam^3. The maximum yield of a single well is in the order of 135 m^3 per day. It has been estimated that wells would have to be spaced at three kilometre intervals in order to avoid unacceptable drawdown interferences.

The Hatfield Valley aquifer underlies an area of about 450 km^2 in the southern portion of the Basin. It is part of the largest and most important buried preglacial valley in Saskatchewan. The Hatfield Valley aquifer runs diagonally from west of the Alberta-Saskatchewan border across Saskatchewan and on into southwestern Manitoba. It is up to 30 kilometres wide, about 550 km in length, and 30 to 50 m thick. The annual yield of the portion of the Hatfield Valley aquifer located in the Basin is estimated at 7,000 dam^3.

Intertill and surficial aquifers are found throughout much of the Study area. They are contained in glacial till overlying bedrock, often within discontinuous sand and gravel lenses within the till. Surficial aquifers within the Basin include alluvial deposits along watercourses and glacial outwash deposits.

Accurately quantifying the study area groundwater supply is very difficult given the shortage of data. Development of the known aquifers is limited, and thus precise information on recharge rates, sustainable yield and areal extent is usually not available. Other aquifers may yet await discovery.

2.4.4 Groundwater Quality

Bredenbury aquifer water quality is variable. In general, the water is marginally acceptable for municipal use but treatment for iron and manganese is required. The water is typically acceptable for livestock use but suitability for irrigation varies from one location to another. Water quality in the Hatfield Valley Aquifer is considered poor and thus limits its use.

Intertill and surficial aquifer water quality is generally superior to bedrock or other deeper aquifers. But, it is susceptible to drought and contamination, due largely to the comparatively rapid recharge rate common to the surficial aquifers.

2.4.5 Existing Major Water Resource Development

Water use falls into two categories — instream or non-consumptive use and either offstream or onstream consumptive use. Offstream water uses withdraw water from its source, and generally return some of it after use. Major offstream uses are in the municipal, domestic and agricultural sectors. Instream water uses include those of fish, wildlife and recreation. Water quality is usually not affected by instream uses. Evaporation from reservoirs and dugouts form the largest onstream consumptive use of Basin water. Withdrawals in the Basin are summarized in Table 2.3.

Municipal and Domestic Water Use

Municipal water use includes cities, towns, villages and hamlets serviced by distribution systems. Commercial and industrial users which are serviced by municipal lines are considered municipal water uses. In addition, there are a number of parks facilities with licensed water allocations which are also categorized as municipal water users for this Study. The total current annual use is estimated to be about 5,500 dam^3, of which 80 per cent is groundwater. There are 54 communities in the Basin that have water systems, serving populations from 21 to over 15,000.

The total current annual municipal water use is estimated to be about 5,500 dam^3, of which 80 per cent is groundwater.

Municipal water use is highly seasonal. Highest monthly pumpages are recorded during the summer months. August is typically the month of greatest water usage. This monthly variation can be linked to residential use for lawn and garden irrigation.

Domestic water use includes households that employ private water supplies, chiefly farmsteads and households in small communities that are not serviced by a municipal system. These users are generally responsible for their own water supply. Sources may include a deep or shallow well, a lake, stream, river or on-farm storage pond or dugout, a cistern which captures rainwater or holds hauled water, or a local water pipeline.

Table 2.3 Summary of Present Annual Withdrawal Uses

Type of Use (% of Total Use)		Saskatchewan (dam^3)			Manitoba (dam^3)			Basin Totals (dam^3)		
		SW	GW	Total	SW	GW	Total	SW	GW	Total
Municipal (9%)	Recreation	0	40	40	0	0	0	0	40	40
	Urban Distribution	970	3930	4900	0	560	560	970	4490	5460
	Total Mun.	**970**	**3970**	**4940**	**0**	**560**	**560**	**970**	**4530**	**5500**
Agriculture (19%)	Irrigation	2120	30	2150	1290	190	1480	3410	220	3630
	Livestock			2540			980			3520
	Domestic			1400			370			1770
	Spraying			240			40			280
	Evaporation	2140		2140	530		530	2670		2670
	Total Ag.			**8470**			**3400**			**11870**
Industrial (6%)	Food Processing	0	30	30	220	0	220	220	30	250
	Cavern Washing	0	1940	1940	0	0	0	0	1940	1940
	Mining	0	1380	1380	0	0	0	0	1380	1380
	Total Ind.	**0**	**3350**	**3350**	**220**	**0**	**220**	**220**	**3350**	**3570**
Wildlife Conservation (30%)		16640	0	16640	2410	0	2410	19050	0	19050
Reservoir Evaporation (38%)		-360	0	-360	24310	0	24310	23950	0	23950
Grand Totals				**33040**			**30900**			**63940**

Note: May not add exactly due to rounding. **SW** - surface water **GW** - groundwater
dam^3 — cubic decametre

Agricultural Water Use

Water used for agriculture includes rural domestic, livestock, crop spraying, irrigation and evaporative losses from dugouts. Current annual water use for agricultural purposes is estimated to be 11,870 dam^3. Rural domestic use is water supplied to farm residences by dugout, well, water hauling or rural pipeline.

The Basin supports both small-scale and intensive livestock operations. Most livestock water use is for non-intensive livestock operations, although there are new intensive operations being proposed, mainly for hog production.

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A significant amount of water is used in the Basin for crop spraying. Cropland may receive one to four applications of pesticides and desiccants during the growing season. There are 106 backflood and sprinkler irrigation projects in the Basin. Dugout use in the Basin is primarily for livestock watering, but it may also be used for rural domestic purposes (household or yard) and for spraying. There are more than 5,500 dugouts in the Basin. Calculating the evaporative loss is an important factor in determining overall agricultural use of water in the Basin. This use is estimated to be 2,670 dam^3 per year.

Industrial Water Use

The industrial use sector refers to those facilities which require significant quantities of water (in excess of four dam^3 per year in Saskatchewan), supplied by a non-municipal source. There are nine licensed industrial water users involved largely in mineral extraction, petroleum, food production and food processing. These water users are collectively allocated about 3,570 dam^3 of water annually. All of the water for industrial use is derived from groundwater in Saskatchewan, and from surface water in Manitoba.

About 3,570 dam^3 of water annually is allocated to industrial use in the Basin.

The largest industrial water user is the Potash Corporation of Saskatchewan's mine near Rocanville, which has wells located just inside the Basin's boundary. Other allocations are associated with the petroleum industry, industrial facilities in the dairy and agricultural fields, and the Asessippi Ski Hill.

Wildlife Conservation Projects and Environmental Water Use

The Basin's water supply sustains 65 wildlife conservation projects which have water allocation licences. These projects are granted allocations that total 19,050 dam^3 of water annually. All of the water is derived from surface water sources. These works provide an abundance of natural habitat for many different species.

Wildlife conservation projects are granted 19,050 dam^3 of water annually.

Wildlife conservation projects are usually natural wetlands with a control structure operated to facilitate waterfowl needs. The licensed allocation for those projects is the total evaporative loss from the surface area of the wetlands, much of which would have occurred under natural conditions. Without a detailed analysis of every project, the cumulative effect of the projects on Basin water use is not known. An examination of the wildlife projects on a case-by-case basis was outside the resources of this Study. Therefore, the net water use of the projects is assumed to be negligible.

Apportionment Water Requirement

As an interprovincial watercourse, the Assiniboine River is subject to the terms and conditions of the 1969 Master Agreement on Apportionment, which applies to all eastward flowing, interprovincial streams in Alberta, Saskatchewan and Manitoba. The agreement is administered by the PPWB, whose members represent the governments of Canada, Alberta, Saskatchewan and Manitoba.

In general, the agreement provides that each province must pass to its downstream neighbour at least 50 per cent of the stream's natural flow which arises in that province plus 50 per cent of the natural flow from the upstream province. Natural flow is that flow which would have occurred prior to any water resources development. In the Study area, the apportionment obligation for the Assiniboine River amounts to 50 per cent of the natural flow at the interprovincial boundary. Since there are no large water use projects on the Assiniboine River being planned in Saskatchewan, apportionment of the Assiniboine River will not be an issue in the immediate future.

Instream and Recreational Water Use

The Basin contains a number of recreational sites including Good Spirit Lake Provincial Park and the regional parks near Sturgis, Yorkton and east of Esterhazy. Good Spirit Lake Provincial Park and the extreme southern portion of Duck Mountain Provincial Park in Saskatchewan, and the western halves of Duck Mountain Provincial Forest and Duck Mountain Provincial Park and Asessippi Lake Provincial Park in Manitoba are within the Basin. Crystal Lake, Fishing Lake and Lake of the Prairies are also important water-based recreational sites.

While fish habitat is recognized as an important instream use of the Basin's water bodies, the requirements for instream flow needs have not yet been completely identified. The Assiniboine River upstream of Lake of the Prairies is a significant spawning area for walleye. Pike, perch and walleye can be found in larger lakes scattered throughout the Basin.

Regulated Lakes and Reservoir Evaporation

Reservoirs in the Basin include Lake of the Prairies, Good Spirit Lake and Theodore Reservoir with smaller ones at Canora and Kamsack weirs. The average annual net evaporation from these five reservoirs is estimated to be 23,950 dam^3. The negative value of average annual net evaporation in Saskatchewan shown in Table 2.3 is due to a large negative value for Good Spirit Lake. The installation of a control structure in the late 1980s at Good Spirit Lake resulted in the lake being operated at a lower full supply level (FSL) than under natural conditions. The lower FSL decreased the surface area of the lake so there is less evaporation under regulated conditions and the net evaporation change due to the project is negative.

3.0 Drainage and Flood Control

The effects of changes in landscape cover and wetland drainage associated with agricultural activities on the runoff regime in the Basin were examined by the Drainage and Flood Control Committee. They also examined the issues of flooding and lake level management. Several water management objectives were identified:

- minimize the potential for damages and hardships caused by extreme runoff and flooding by improving development planning and knowledge of the Basin's water resources;
- promote sound land and water management practices to ensure the long-term sustainability of agriculture, and wildlife and aquatic resources in the Basin; and
- encourage a planned watershed approach, and increase public knowledge and awareness of water management and the Basin's water resources, in an effort to ensure orderly drainage in accordance with regulations and public policy.

A description of the issues and concerns affecting drainage and flood control in the Basin follows. Options were identified to address the issues. The findings and conclusions of the Drainage and Flood Control Committee have been incorporated in the issues and options, while recommendations appear at the end of each section. The Committee's report is available under separate cover (Appendix A).

3.1 Flooding

The high flows in the Basin in 1995 can be attributed to a combination of meteorological events. Runoff from high precipitation in the fall of 1994 had nearly filled many of the natural wetlands and soil moisture levels were high, reducing the natural storage available for spring snowmelt runoff. There was an above-normal snowpack followed by a mid-April rainstorm, which contributed additional runoff water and caused rapid melting of the snowpack. This rapid melt across much of the Basin resulted in an unusual hydrologic condition — the nearly coincident peak flows on the Assiniboine and Whitesand rivers at Kamsack, as well as on smaller local tributaries between Kamsack and Shellmouth Dam. Shellmouth Dam significantly reduced flow rates and water levels downstream from what would have occurred had the dam not been in place. To compound the situation locally, high levels in the receiving streams reduced or prevented flow from many drainage ditches. Similar conditions resulted in a major flood in the spring of 1922.

Conclusions:

Climatic processes dominate the generation of major flood events.

Drainage of wetlands has little effect on major flood events.

Drainage works in the Basin did not contribute significantly to the observed 1995 flood peaks and volumes. These can be attributed to natural conditions.

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3.1.1 Issues

There is one major issue related to flood damage in the Basin.

Issue:
Flood damage often occurs because of inappropriate land development and use in flood prone areas.

A flood is largely a natural phenomenon and will occur in flood prone areas as climatic processes dictate. Flood prone areas include agricultural land adjacent to streams and water bodies, various lake and reservoir shorelines, and several small communities.

Where incompatible developments and land uses occur on these flood prone lands, flood damages can be expected. However, where wetland drainage has occurred upstream of the damage site, the tendency of the affected landowner is to point to this drainage as the cause of the flood and resulting damage, rather than examining the appropriateness of his/her own use and development. Long-term risks and costs of flood damage will be minimized only when compatible land uses and appropriate developments exist in flood prone areas.

The climate of the Basin is cyclical. There are often extended periods of drought or excess surface water. During low runoff years, there is a tendency to encroach onto areas which are periodically subjected to flooding. The Local Watershed Committees suggested that a flood damage reduction program is needed in the Basin.

Recommendations

- **Water management agencies should expand efforts to promote awareness throughout the Basin of the hydrologic processes that lead to large floods, as well as the effect of water control projects on flow rates and water levels.**
- **Provincial and local governments should ensure that additional development does not occur within flood prone areas through a review of the processes for subdivision approvals and granting of building permits.**
- **Programs should be developed to encourage the adoption of compatible land use practices in a flood prone area in order to reduce damages to agricultural lands and urban developments located adjacent to streams and water bodies.**
- **Studies should be conducted to determine if engineering works are a practical method of reducing the risk of flood damages to existing developments in flood prone areas.**

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3.2 Drainage and Water Management

Drainage technology has allowed a great deal of land in the Basin to be successfully developed for agriculture over the past 100 years. There is an interest in developing the land further for agricultural use, including draining wetlands because they interfere with agricultural operations. Some problems with wetlands identified by landowners are flooding during years of higher precipitation, delay in spring seeding, increased costs and inconvenience of working the land around wetlands particularly with larger equipment, and weed growth in wetland margins.

Drainage systems and changes to native land cover can alter the environment by draining wetlands, removing riparian zones, increasing runoff and changing a basin's hydrology. Through workshops, residents of the Basin identified a number of concerns about municipal and agricultural land and water management practices in the Basin. Among these are:

- flooding of neighbouring land caused by upstream land drainage;
- potential increases in volume of water in stream courses;
- decrease in wildlife habitat (uplands, wetlands, riparian);
- pollution of surface water and groundwater;
- impacts on fish and fish habitat; and
- impacts of flooding along the Assiniboine River valley downstream of Shellmouth Dam.

Properly designed and maintained drainage systems may alleviate some of these effects, but lost riparian and wetland systems are usually difficult and expensive to replace. The challenge for agricultural producers is and will be to maintain sustainable and profitable agricultural production on low-lying areas. At the same time they are expected to develop drainage systems that are environmentally sensitive and integrate well with local ecosystems.

Agricultural land drainage

3.2.1 Issues

Three issues that affect water management in the basin have been identified:

- downstream property owners believe that wetland drainage in upstream areas leads to increased flooding;
- downstream property owners believe that changes to land management practices upstream have altered the runoff response; and
- extensive unauthorized drainage has occurred and continues to occur.

Issue:
Downstream property owners believe that wetland drainage upstream in the watershed leads to increased flooding.

Nearly six per cent of the Basin area is made up of permanent and semi-permanent wetlands that temporarily retain the spring runoff. Small wetlands (less than 4.0 hectares [9.9 acres]) are the most vulnerable to drainage. They comprise a large percentage of the total number of existing wetlands but only a small percentage of the Basin's total wetland area and volume.

Wetland Loss

Wetland loss within select areas of the Basin is about 45 per cent since the 1950s and most of that drainage occurred prior to 1980. In those areas, current efforts are directed at maintaining and improving the existing drainage systems. However, new unauthorized drainage of temporary and seasonal wetlands using contour ditches and V-ditching continues. These activities generally increase following wet years and are most prevalent in areas with a high density of wetlands and on lands being incorporated into larger farm units. There is potential for high wetland loss in areas of the Basin where extensive unauthorized drainage has not yet occurred.

Currently, wetland loss due to drainage can only be determined by comparing air photos from different eras. However, this approach of identifying drainage is somewhat uncertain because the drains are not always visible on the air photos. In addition, it is possible that the loss of wetlands may be due to differences in climatic conditions, and not human activity. The development and use of remote sensing technology should be considered for the detection of unauthorized drainage.

There is currently no practical, cost-effective method of detecting wetland loss due to unauthorized drainage on a Basin scale.

The loss of wetlands on privately owned land in the Basin is the result of several factors faced by producers such as economics, crop selection, climate, farm size, and equipment size. The cost of land and the need for efficiency encourages producers to maximize cultivated area within their present holdings before

acquiring additional lands. As land changes hands from smaller, retiring producers to modern, larger producers the first steps often taken are to clear and drain in order to make the operation of large expensive farm equipment more efficient, and to maximize cultivated areas. The short growing season coupled with the large land base necessitates being on the land as soon as possible in the spring. Drainage helps to accomplish this objective.

A lack of moisture is not normally a limiting factor for crop production in the Basin. In fact, excess spring moisture often delays seeding, further increasing the pressure to drain wet areas. Also, while land retained for wildlife habitat has an aesthetic value intrinsic to a rural lifestyle, there is no financial advantage for a landowner to maintain habitat or convert agricultural land for wildlife use.

Producers have expressed concern about the potential for an over-riding focus on environmental values that may affect the ability of the landowner to develop land. Some agricultural producers believe that many wetlands are of no benefit to either waterfowl or agriculture because they dry out too early in the year.

The Hydrologic Impacts of Drainage

Wetland drainage will, in general, increase runoff volumes. The greatest impact on flows is during moderate runoff events, with the effect diminishing for larger flood events. In general, drainage projects with regulated outflows can have less effect on downstream flows than projects that are not regulated but only up to the point where they are drowned out.

The effect of an individual drainage project or group of projects at any location can be assessed using hydraulic and storage routing models in small watersheds.

Conceptual application of hydraulic routing on simple wetland systems indicated that in years with low or moderate runoff, natural wetlands capture and hold snowmelt runoff which then evaporates over the summer. In years when water levels in natural wetlands are high before the spring runoff begins, little of the snowmelt runoff can be stored in the wetland. The same conceptual application shows that drainage of wetlands without control structures will increase runoff volumes and will increase peak flows, at least locally, in most years. Effects further downstream depend on project location within the larger watershed, number and location of other projects, and the relative timing of natural flows and project outflows. Finally, the conceptual application shows that projects with structural works which can regulate outflows have the ability to minimize downstream effects and control the timing of peak outflows, in most years.

Conclusion:
The greatest impact of drainage of wetlands is during moderate runoff events, with the effect diminishing for increasingly larger flood events.

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Conclusion:
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Data requirements for hydraulic models are prohibitive and there are large numbers of undocumented drainage works which could not be considered in the model. This Study found no practical method to detect and map historical wetland drainage on a large watershed scale.

Recommendations

- **Water and wetland management agencies should work to define common standards and definitions in the assembly of wetland databases.**
- **Research agencies should focus on developing remote sensing technology for application to the detection of unauthorized wetland drainage on the Prairies. In addition, provincial agencies should continue to monitor developments in remote sensing technology with a view to future application in detection of unauthorized wetland drainage.**
- **The construction of works such as backflood projects or controlled drainage should be promoted in conjunction with drainage project approvals to minimize downstream effects.**
- **The retention of existing natural wetlands should be promoted where those wetlands provide significant water management benefits by controlling snowmelt runoff into the stream network in most years.**
- **The planning and approval of drainage projects should be undertaken within the context of a local watershed plan that considers the impacts of existing and proposed projects on downstream locations. The plan should include operating guidelines for controls on drainage works. It is further recommended that economic and other factors faced by producers in their decision whether or not to drain wetlands be considered in the development of environmental, social, or economic programs or policies to address drainage issues.**

Issue:

Downstream property owners believe that changes to land management practices within upstream portions of the watershed has altered the runoff response of the Basin.

The landscape of the Basin has undergone great change since settlement. Where once the Basin was a natural prairie and parkland, the most prevalent land use today is annual cropping. Statistics Canada census information dating back to the 1950s indicates that improved area has increased from 56 per cent to 77 per cent of the reported land area. Unimproved area has fallen from 44 per cent to 23 per cent. This unimproved area is comprised primarily of woodlands, native grasslands, and wetlands (see Figure 2.1, page 15).

A comparison of mapped wooded area in the 1950s with that mapped more recently shows that many small, isolated woodland stands have been eliminated, while larger stands have been less affected. However, data indicate that the rate of conversion into agricultural production has slowed over the past two decades. The reduction on the rate of land improvement may be because the limit of area that can practically be developed is being approached.

The Effects of Land Cover on Runoff Volumes

A hydrologic analysis of streamflow records indicated that runoff volumes have been increasing. Although regression analysis revealed a high correlation with land use change, the cause of the apparent increasing trend in runoff was not apparent using only streamflow records. A significant limitation was that many land cover changes predate most hydrometric stations in the Basin.

Conclusion:

Effects of land cover changes and wetland drainage in the Basin could not be quantified, but a trend of increasing runoff volume was detected.

Land cover has an effect on the redistribution of snow by wind within a watershed. Models such as the Simple Lumped Reservoir Parametric (SLURP) model, when calibrated and functioning properly, should be able to determine how various land covers affect snow redistribution and consequently spring snowmelt and runoff.

The loss of smaller woodlands may affect Basin hydrology by increasing snow transport and reducing the number and frequency of areas where snow may accumulate. Prairie-based research results suggest that overwinter stubble retention on a watershed basis and/or conversion to permanent cover is likely to reduce overall runoff volumes and spring peak flow rates. Overwinter stubble and permanent cover tends to hold snow in place better, improve infiltration, and slow the overland flow of water. Recent trends away from summerfallow to continuous cropping and reversion of cropped land to permanent cover are believed to offset, to some degree, the apparent trend toward increased runoff volumes.

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Impacts of Road Construction

The extensive road infrastructure within the Basin may have an effect on the hydrology of the Basin. Road-side ditches, designed to drain the road bed, by necessity pass through natural runs and watercourses. While surplus water is removed from the road edges, it is also possible to drain nearby wetlands into these ditches.

Where culverts or bridge openings through a roadway are undersized or blocked by debris, the road bed can cause temporary storage and attenuate the peak flow. Normally, the greater the flood the greater the attenuating effect until the road grade is overtopped and or washed out. This temporary road grade storage may be significant within the watershed and changes continuously with changes to the road network .

Summary

Changes in Basin land cover, including losses of wooded area and wetlands, conversion from grass to cultivation, and road development have resulted in increased runoff volumes over what would have occurred naturally (before settlement) in the Basin.

Recommendations

- **Research agencies should continue investigations into the relationship between snowmelt runoff in the Basin and agricultural practices such as stubble management and conversion to permanent cover. Specifically, two similar small watersheds in the Basin should be identified and monitored, one receiving intensive stubble management and conversion treatment while the other remains as representative of current agricultural practices.**

- **There should be incentives encouraging producers to use agricultural practices such as conservation tillage, and permanent cover programs that retain or re-establish native land cover as means to reduce runoff rates and volumes.**

Issue: Extensive unauthorized drainage has occurred and continues to occur.

Local concern over unauthorized drainage is most pronounced during periods of above average runoff when the additional flow is perceived to be the cause of downstream problems such as flooding of agricultural land, overtopping of roads, streambank erosion, and reduced water quality. After the spring flood of 1995, many downstream residents in the Basin felt very strongly that the upstream unauthorized drainage of thousands of sloughs resulted in, or at least aggravated, the extreme flooding and related damages that occurred.

Downstream landowners feel forced to undertake their own drainage works and channel improvements (often unauthorized) to pass the surplus water along. Where such works are not possible, practicable nor desirable, the flooding can render farmland unsuitable for production temporarily, seasonally or even permanently.

Legislative Authority

The governments of Saskatchewan and Manitoba have the authority through legislation to regulate drainage that requires approval prior to the construction of drainage works. The regulatory review of each drainage proposal includes an assessment of the impacts on the environment. This regulatory function requires resources for technical and administrative staff to carry out the review. Each province has the ability to establish local authorities to develop and maintain drainage works. Even though extensive legislation exists, the number of unauthorized drainage works is far greater than authorized drainage works.

The unauthorized drainage issue was reviewed at the Unauthorized Drainage Workshop in June 1999 with rural municipalities, conservation and development area authorities, watershed associations and the Upper Assiniboine River Conservation District. The workshop concluded that unauthorized drainage work construction is due to a lack of awareness of the requirement for approval, a concern that the approval process is too cumbersome and lengthy, an unwillingness to apply for an approval for fear of being denied development, and a lack of government resources to quickly enforce compliance with the legislation. Some landowners feel there should be more control over drainage activity and the government should direct more funds towards enforcement of the legislation. Others support less emphasis on the regulatory requirements and more local authority in the management of drainage works.

Local Watershed Committees felt that unforeseen downstream problems (flooded agricultural land and municipal infrastructure damage) created by unauthorized drainage should be mitigated. As well, they felt that there should be adequate resources for a workable process to approve farm drainage projects.

The current framework for regulating drainage in Saskatchewan and Manitoba is largely ineffective in controlling drainage of small prairie pothole wetlands within a farm unit. Changes to legislation and or substantial additional resources allocated to enforcement are required to address the issue of unauthorized drainage and to regulate the operation of existing drainage works in the Basin.

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3.2.2 Options

Understanding the relationships between land and water management and the hydrologic implications is an ongoing learning process. Increased intensified use of agricultural land has simultaneously created a greater importance for retaining the remaining wildlife habitat over time. This has created a need for direction on land use management to guide prudent water management approval of drainage works. The Study identified three options for water management in the future:

- continue to develop comprehensive runoff simulation models for prairie conditions as found in the Upper Assiniboine River Basin;
- develop and implement a new approval process for land drainage; and
- develop and implement amendments to legislation with resources to enforce requirements for land development.

Option:
Continue to develop comprehensive runoff simulation models for prairie conditions as found in the Upper Assiniboine River Basin.

The application of the SLURP model was successful in modeling flows for larger watersheds with the current land cover base (1995-97). In addition, the modeling exercise demonstrated that GIS methods are able to generate land cover data required for semi-distributed hydrologic models and also demonstrated the successful application of digital elevation modeling in generating the topographic data required for hydrologic modeling. While the modeling was not successful in determining the effect of land cover change on Basin runoff, it does not preclude the eventual success of such an initiative with a complete land cover model of both the pre-development condition as well as the current land cover.

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The Local Watershed Committees have mixed support for continuing research and development of the SLURP model. Some members were critical suggesting that the model will probably never work. Others suggested that further refinements of the SLURP model will make it a useable and practical management tool sometime in the future. Some members felt that local people should have input on the various practical applications of the model.

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Option:
Develop and implement a new approval process for land drainage.

Acquiring approval for agricultural land drainage is far more complicated today than ever before. Greater cooperation between landowners and municipal councils is necessary to resolve local drainage problems. Wildlife habitat protection has become a consideration for approval of a drainage proposal. Environmental pressures are viewed as unfair by many farmers. They feel the business, financial and taxation realities they face are not fully recognized. Farmers feel helpless to resolve the agricultural/environmental issues on their own or to handle land development much differently than in the past.

Assistance may be needed to acquire the expertise of independent specialists to address drainage problems and to determine their impact on water and related resources. Local involvement may be needed in cooperation with provincial and municipal governments. Agricultural land drainage decisions are becoming community-based decisions because of increased, intensified agricultural land use.

The legislation that applies to agricultural drainage requires substantial community understanding and awareness of the downstream implications of drainage. A complement to implementing drainage legislation (regulations) would be the use of a more collaborative approach that involves all the prospective partners and stakeholders in a watershed management plan.

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One-Window Approach

A new government approval process should be developed that would provide a coordinated, "one-window" effort to achieve environmentally sensitive agricultural land drainage. The process should have organized local involvement and take place within a reasonable time frame. To expedite the process, any project proposal should have the necessary information complete prior to being submitted for approval. To assist project proponents, any legislative requirements and supporting information guidelines should be clearly identified along with instructions on how to prepare an acceptable project proposal. Technical information and environmental mitigation should be developed as part of the project proposal and not as part of the approval process. A watershed management plan that identifies agricultural and environmental land use considerations and the natural and constructed drainage system would assist a proponent in developing a project proposal.

A new approval process should be developed that would provide a coordinated, "one-window" effort to achieve environmentally sensitive agricultural land drainage.

Participants in the Unauthorized Drainage Workshop and Local Watershed Committees agreed that there should be adequate resources to provide an effective and workable process for drainage development.

Code of Practice

A "code of practice" for drainage works should be developed by provincial agencies with local input. Criteria defined under the "code" would be used as a tool by proponents to prepare a project proposal. Legislative changes may be required for a "code" to be used for approval of drainage works. This same "code of practice" may be used in a complaint process to determine if drainage works would remain open or closed. Until the "code of practice" and drainage criteria are established, the interim drainage guidelines should remain in effect (Sask Water, 2000). A local watershed association may be formed to coordinate agency and municipal input and to assist farmers in preparing a project proposal for approval.

Information Requirements

Agricultural, engineering and environmental perspectives need to be considered in preparing and approving a drainage proposal. This would be an expansion of the criteria contained in the Guidelines for Approval of Drainage Works within the Upper Assiniboine River Basin. Application of the drainage criteria would depend on the situation and complexity of the drainage project proposed. Detailed information developed to support practical application and definition of drainage project criteria is required.

Examples of Information Requirements

Agriculture

- Drainage on agricultural land based on an approved watershed management plan.
- Agricultural land use classification (current land cover).
- Economic evaluation of the proposed drainage project.
- Water quality control requirements such as vegetated buffer strips, grassed waterways.
- Riparian area setback from a natural stream.
- On-farm drainage plans.

Engineering

- Land control plan.
- Point of an adequate drainage outlet.
- Location plan with drainage area based on an approved watershed management plan.
- Hydrology and hydraulic information.
- Typical cross sections and a profile plan.
- Grassed waterways.
- Erosion and gradient control structures.
- Drainage outlet controls with a controlled drainage outlet operating plan.

Environmental

- Maintain wildlife habitat based on an approved watershed management plan.
- Retain wetlands to offset drainage with water storage.

The more intensive the agricultural land use, the greater the detail needed to make prudent land and water management decisions. A land use plan that identifies land for farming, wildlife, and other uses is needed to guide water management. Agricultural, environmental and other interests should work together to provide sound land use management direction upon which to base water management decisions with local participation. Participants in the Unauthorized Drainage Workshop concluded that a coordinated government agency effort needs to be mounted to establish a "master plan" for land use.

Recommendation

- **Any environmental, social, or economic programs or policies to address drainage should consider the economic and other factors faced by producers in their decision whether or not to drain wetlands.**

Information Requirements

Agricultural, engineering and environmental perspectives need to be considered in preparing and approving a drainage proposal. This would be an expansion of the criteria contained in the Guidelines for Approval of Drainage Works within the Upper Assiniboine River Basin. Application of the drainage criteria would depend on the situation and complexity of the drainage project proposed. Detailed information developed to support practical application and definition of drainage project criteria is required.

Examples of Information Requirements

Agriculture

- Drainage on agricultural land based on an approved watershed management plan.
- Agricultural land use classification (current land cover).
- Economic evaluation of the proposed drainage project.
- Water quality control requirements such as vegetated buffer strips, grassed waterways.
- Riparian area setback from a natural stream.
- On-farm drainage plans.

Engineering

- Land control plan.
- Point of an adequate drainage outlet.
- Location plan with drainage area based on an approved watershed management plan.
- Hydrology and hydraulic information.
- Typical cross sections and a profile plan.
- Grassed waterways.
- Erosion and gradient control structures.
- Drainage outlet controls with a controlled drainage outlet operating plan.

Environmental

- Maintain wildlife habitat based on an approved watershed management plan.
- Retain wetlands to offset drainage with water storage.

The more intensive the agricultural land use, the greater the detail needed to make prudent land and water management decisions. A land use plan that identifies land for farming, wildlife, and other uses is needed to guide water management. Agricultural, environmental and other interests should work together to provide sound land use management direction upon which to base water management decisions with local participation. Participants in the Unauthorized Drainage Workshop concluded that a coordinated government agency effort needs to be mounted to establish a "master plan" for land use.

Recommendation

- **Any environmental, social, or economic programs or policies to address drainage should consider the economic and other factors faced by producers in their decision whether or not to drain wetlands.**

Option:

Develop and implement amendments to legislation with resources to enforce requirements for land development.

The construction of drainage works is regulated by provincial agencies to protect the environment and to protect downstream interests from significant damage as a result of drainage development. The Local Watershed Committees suggested proper resources are required for effective detection of unauthorized drainage and proper enforcement is needed. Adequate resources need to be made available to inform the public about drainage and land improvement regulations that are contained in the existing legislation and any new regulations or legislative changes.

Complaint/Mediation Process

Agricultural landowners are aware unauthorized drainage is still happening in the Basin. Some do not appear to be concerned that increased runoff causes downstream problems. The only tool currently available to landowners who are impacted by unauthorized drainage is the formal complaint process.

A local watershed association could become a mediator to help resolve complaints through organized local citizen group discussion. This would remove a burden from government resources. Some Manitoba Conservation Districts use this approach. A local association could be instrumental in bringing groups and landowners together to examine the problems created by unauthorized drainage to create better understanding of the impacts and improve the 'will' to comply with any decisions regarding a complaint.

As part of the mediation process, a local association could develop a mitigation program for unforeseen downstream problems created by drainage. The upstream landowner would be responsible for mitigating downstream landowner damages. A detailed watershed management plan could serve as an enforcement tool for identifying the natural and constructed, authorized drainage system.

Organized local involvement in dealing with drainage complaints coupled with a detailed watershed management plan may increase compliance and could reduce the need for enforcement of legislative requirements. The provincial agencies could invoke the enforcement process should local mediation and discussion fail to resolve an unauthorized drainage problem.

Enforcement

There is provincial regulatory agency support and some public support for improving the enforcement process of legislative land drainage requirements. There are three main steps to consider in the process.

Step 1: Identification of Illegal/Unauthorized Works

Improve enforcement support technology to determine baseline conditions such as:

- Orthophotography showing drainage that is approved.
- Use of computer programs for examining aerial photos and licensing databases.

Step 2: Enforcement Action

a) Corrective/Remedial Process

Improve the mechanism for reclaiming costs of closing drainage works from the offender such as:

- A new method of closure where some licensing solutions could be found during closure process.
- Obtain an agreement with municipalities to recover costs through local taxes.

b) Penalty

Change legislation to give the province the ability to levy fines and offence notices which can also apply to old unauthorized works.

Undertake a program for public awareness of the consequences of enforcing legislation to encourage compliance.

Step 3: Ongoing Compliance

Establish an ongoing monitoring program for compliance with remedial work measures to ensure that the resources spent on the initial enforcement are protected. Consequences associated with removal of remedial works could be outlined in the legislation.

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3.3 Lake Management

Multiple interests in the use of lakes and reservoirs have resulted in conflicts over water level management and the operation of outlet control structures. While specific effects for individual lakes were not evaluated, this Study has found a trend of increasing runoff volumes in the Basin. Where there is a limited outlet or downstream channel capacity, water level management is made more difficult by increasing flow volumes over what would have occurred naturally into the lakes. In general, changes in land cover and drainage of wetlands upstream of lakes and reservoirs has increased runoff volumes into those water bodies. This has the impact of reducing operational flexibility for reservoirs compared to when they were designed and constructed.

3.3.1 Issues

There is one major issue concerning water management of lakes in the Basin.

Issue:
Conflicts occur among various user and interest groups over the management of lake levels.

During above average runoff conditions Fishing Lake, Good Spirit Lake, and Lake of the Prairies may have inadequate outlets or downstream channel capacities to permit effective management of water levels. This is further complicated by changes in land cover and the loss of upstream wetlands resulting in increased runoff volumes being released downstream.

Intensified land and water use development upstream, downstream and adjacent to the lakes over time has put public pressure on lake management to support sometimes conflicting multiple interests. Resolution of public pressure may only come about through development of a watershed management plan, or at least a lake management plan, that brings all of the interest groups together to make the best decision possible for all those concerned. Ultimately, a lake can only be managed to benefit most of the people most of the time as not all problems for every situation can be resolved to everyone's satisfaction.

Fishing Lake

Fishing Lake is considered a closed basin although it reached a spill elevation in 1997 that was purported to have last occurred in 1922. The high water levels of 1997 and subsequent years have seriously affected cabins and property developed for recreation situated below the natural spill elevation of the lake. Many cabins have been damaged or destroyed as a result of the high waters and beaches have been inundated. Septic tanks are under water and their contents have washed away. Although Sask Water identified a safe building elevation at Fishing Lake, development still occurred below this level.

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Some people perceive that drainage and land use changes in the Fishing Lake watershed are partially responsible for high water levels in the lake. In times of drought, people appreciate more runoff from drainage to enhance water supply to the lake. In the 1960s a drainage scheme was considered to divert water from Milligan Creek, which drains into Little Quill Lake, to raise the level of Fishing Lake.

In the late 1990s, the problem of high water levels led to the proposal of an outlet control structure and ditching to the Whitesand River with the intention of lowering the spill elevation of Fishing Lake. This was intended to provide flood protection to property around the lake. Some downstream effects, due to lowering the spill elevation and increasing the release of water from Fishing Lake, were identified. The water of Fishing Lake has a high sulphate component and to add this water to the Whitesand River may possibly affect downstream water uses. Manitoba also expressed concerns over the water quality and the additional volume of water which would enter Lake of the Prairies.

Fishing Lake, 1997

Some Local Watershed Committee members believe that a structural solution, which may partially reduce flood damages, could be combined with controls on subdivision development. Controls would include strict compliance with lot/building elevations and *The Shoreland Pollution Control Regulations* (Saskatchewan).

Good Spirit Lake

The Good Spirit Lake Watershed Association was established in 1986 to sponsor development and operation of flood control works to stabilize lake levels and to ensure adequate outlet conveyance capacity. Prior to the construction of the outlet control structure in 1990, the lake had a history of dramatic water level fluctuations. The lake is shallow with a very flat bottom. As water levels fluctuate, the shoreline can move long distances. Periods of high runoff resulted in flood damages around the lake and to downstream agricultural lands. Low runoff has also been a concern for the recreational interests around the lake. There are differences of opinions among water users on the optimal operating level for the lake. Another concern stems from the lack of cottage owner representation on the watershed association board.

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The Good Spirit Lake Watershed Association conducts a fall and winter draw-down operation of the lake. This is intended to create storage for flood protection of properties around the lake and along the outlet channel. Some residents are concerned that lake levels will not recover in the spring and will have a negative impact on recreational activities. The risk in lowering water levels over the winter, based on an anticipated spring runoff, is that if little runoff actually occurs, the lake would be undesirably low during the following summer and possibly subsequent years. Conversely, the outlet capacity of the lake is insufficient to remove large volumes of water quickly, causing lake levels to remain at a flood stage for extended periods. Complaints from various recreational interests continue over the optimal operating level of Good Spirit Lake.

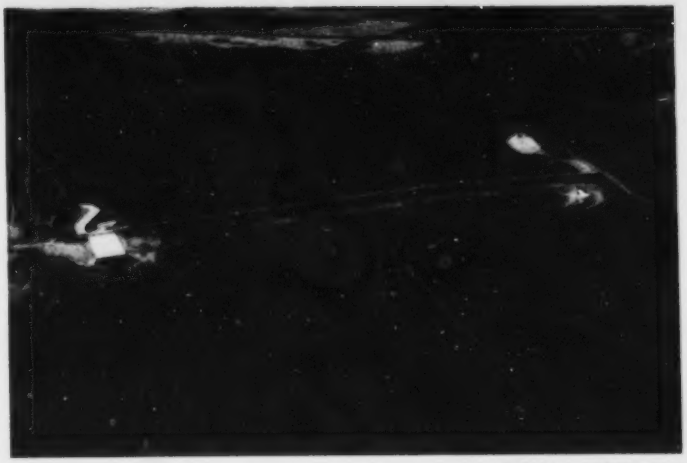
Lake of the Prairies

Lake of the Prairies provides recreation, flood control, and downstream water supply benefits, each with its own lake level requirements. The lake is operated for the benefit of all Manitobans. Managing the lake levels for recreation and water supply uses often conflicts with managing the lake for downstream flood control. Large lake level fluctuations are not compatible with recreational activities such as boating, swimming and in particular cottage development. Fish habitats may also be affected by lake level fluctuation. Reducing lake level fluctuations to meet recreational interests decreases the effectiveness of the original flood attenuation and water supply purpose and can result in a conflict over use of the reservoir and its associated management guidelines.

Lake of the Prairies is typically operated over the fall and winter such that storage is available for the management of spring runoff. In November, reservoir operations are planned based on fall precipitation and adjustments are made as the winter progresses based on snowfall accumulation. The wetland storage upstream of the lake is an important element in Manitoba's flood management considerations, and loss of a significant portion of that upstream storage could have implications on the management of Lake of the Prairies for flood control. The significance of these implications on the operation of Shellmouth Dam should be jointly examined by Manitoba and Saskatchewan.

Before construction of the dam, flooding of valley bottom land downstream of the dam occurred on three years out of five on average. The flooding was usually not critical since it occurred over frozen soils then used mostly for hay production. While the dam has now reduced the frequency of flooding below the dam to an average of one year in five, a shift in land use towards more cultivation has resulted in greater impacts of floods when they do occur. The most flood prone area is immediately below the dam for a distance of about 16 km. In this reach, approximately 1,800 hectares of land (4,446 ac) were flooded in 1995.

The operation of Shellmouth Dam has always recognized the restricted channel capacity below the dam. When the dam was built, it was originally thought the channel capacity downstream of the reservoir was in the order of 100 m^3/s. During the initial years of operation, the dam was operated assuming this channel capacity. Local residents below the dam expressed concerns that the operation resulted in an increased duration of flooding and inhibited drainage of cultivated areas.



Shellmouth Dam

Investigations indicated flows up to about 51.0 m^3/s can be handled by the river and adjacent dyking system immediately below the dam without flooding low-lying oxbows now used for crop production and without raising the water table high enough to impact cropping throughout the valley floodplain. The operating rules were modified over time to consider a reduced channel capacity and changed land use. At present, an attempt is made to maintain the outflows from the reservoir to no greater than 45.3 m^3/s to permit adequate land drainage. Nevertheless, complaints from landowners in the valley downstream of Shellmouth Dam continue.

Local Watershed Committee members discussed a number of possible approaches to improve the operating flexibility for Shellmouth Dam:

- purchase flood prone land in the valley downstream of the dam;
- acquire easements on flood prone land to compensate valley landowners for flood damages;
- compensate valley landowners for flood damages above those that would have occurred naturally;
- undertake engineered channel improvements downstream of the dam to increase flow capacity;
- increase flood control capabilities by developing other water supply storage facilities closer to the water user; and
- install flash boards or gates on the spillway to increase flood storage.

There is, at best, mixed public support for all of the approaches except for installing flash boards or gates. Neither upstream landowners nor valley landowners are in favour because they feel this would flood more land upstream and increase the duration of flows downstream of the dam affecting drainage of valley lands.

The flexibility in operating Shellmouth Dam will not likely be improved until landowners are willing to compromise and agree on a solution. This solution would also have to be acceptable to the Manitoba and Saskatchewan governments.

3.3.2 Summary

Following review of the specific management issues respecting lakes in the Basin, the Drainage and Flood Control Committee determined that in some situations, engineering works may be the only method of reducing the risk of flood damages to existing developments in flood prone areas. However, long-term risks and costs of flood damage can be minimized by ensuring that only compatible land uses and appropriate developments occur in flood prone areas.

Conclusion:
Increased runoff volumes into lakes gives rise to management problems and reduces operational flexibility of reservoirs.

Recommendation

- **Both structural and non-structural measures should be investigated to improve operational flexibility of lakes in the Basin.**

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Recommendation

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4.0 Wetland and Upland Conservation

Wetlands and their associated uplands provide a habitat for a wide range of plants, waterfowl and other birds and animals throughout the Basin. The potential for loss and alteration of habitat is the leading concern surrounding the depletion of the Basin's remaining wildlife resources, and ultimately its biodiversity.

The biodiversity of the Basin can be measured by the abundance of wildlife species and populations within the area. Wetland ecosystems contribute in large measure to this biodiversity, and as they are lost or altered, the biodiversity of the region is ultimately affected.

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Agriculture and other rural development activities often lead to land clearing, drainage, and channel clearing, which can alter the physical nature of waterways and affect both the quantity and quality of wildlife habitat. On the other hand, some wildlife species are able to thrive where native habitat has been replaced by agriculture.

An objective for the Basin is to promote prudent land and water stewardship for the long-term sustainability of agriculture, wildlife and aquatic resources.

This section discusses habitat issues and summarizes the findings, conclusions and recommendations of the Wetlands Committee presented in its report, available under separate cover (Appendix C).

4.1 Wildlife Habitat

The Wetlands Committee identified the types of wetlands and uplands in the Basin and the wildlife uses of these landscapes as well as their extent and distribution.

4.1.1 Wetland Types and Wildlife Use

The location, size and type of wetlands are the result of a number of factors, such as the influences of glaciation and climatic cycles. Subsequent vegetation and succession of plant communities have also influenced the wetland characteristics. Wetland types have been classified by the permanency of the water they contain, and the type of vegetation present under different moisture conditions.

Temporary Wetlands

Temporary wetlands are usually small, shallow depressions which normally become dry by the end of May. They contain fine-stemmed grasses and sedges and a wide variety of herbaceous plants. Even though they dry up early, these wetlands provide foraging habitat for migrating water birds, and are an important stimulus

for nesting by many species. They also provide "behavioural" habitat by providing resting sites as part of the territories of many species of water birds. After the water disappears, these wetlands provide nesting cover for a variety of ground-nesting songbirds and small mammals, and foraging habitat for larger mammals.

Conclusion:
Temporary and seasonal wetlands are the most common types in the Basin. They are as important for wildlife breeding and foraging as more permanent wetlands.

Seasonal Wetlands

Somewhat deeper than temporary wetlands, and usually larger, seasonal wetlands often retain water until late July. Coarse grasses and sedges, and taller herbaceous plants dominate. Seasonal wetlands provide important foraging habitat for many species of water birds, and brood-rearing habitat for many species of ducks.

Semi-Permanent and Permanent Wetlands

Semi-permanent wetlands retain some water until freeze-up in most years. They are usually larger and contain a mosaic of open water and coarse emergent vegetation such as cattails or bulrushes. Permanent wetlands contain surface water throughout the year except after periods of prolonged drought. They usually have a large central area of open water, and are often rimmed with coarse emergent vegetation.

Semi-permanent and permanent wetlands provide important long-term water supply for many wildlife species from spring to fall. They provide brood-rearing habitat for water birds. The greater the diversity of vegetation within and along shorelines, the greater the diversity of species of wildlife using these wetlands.

Riparian Wetlands

Riparian wetlands include streams and rivers ranging from intermittent waterways to those with continual flows, and the vegetation along their shorelines. Shoreline vegetation can include grasses and sedges and coarse emergent vegetation, and shrubs or trees. Riparian habitat along streams and rivers is extremely productive for wildlife because of the complex diversity of vegetation. These habitats also provide important corridors for movements of wildlife within a given region.

Lakes

Lakes provide important habitat for species which forage on fish, or require more isolated sites for breeding such as nesting islands. Shorelines may vary from beaches of sand, gravel or rock cobble to emergent vegetation or grasses and sedges.

Artificial Wetlands

Examples of artificial wetlands include dugouts, stockponds and borrow pits. They usually contain water throughout the year, and have variable vegetation along their shorelines. Artificial wetlands can provide important sources of water for larger mammals, brood-rearing habitat for waterfowl and other water birds during periods of drought, and habitat for amphibians during dry periods.

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4.1.2 Upland Types and Wildlife Use

Upland habitats include terrestrial communities adjacent to, and distant from, wetland habitat. They include altered landscapes (agricultural areas) and undisturbed or somewhat modified landscapes (areas of native vegetation). The most notable characteristic of upland habitat is the broad range of plant species.

Woodlands

In the woodlands, deciduous trees such as trembling aspen, balsam poplar, Manitoba maple and white birch dominate. Many species of shrubs and herbs are found in the understory. Woodlands provide habitat for a wide variety of birds and mammals. Different species use different portions or layers of the woodland environment for breeding and foraging, and some use many areas of the woodlands.

Shrublands are an important structural component of the woodlands and are often scattered in grasslands where they provide habitat for nesting or foraging or breeding activity. They are important habitat along the edges of wetlands.

Mixed Woodlands

Mixed woodlands provide the greatest diversity for breeding bird species. Here, the dominant tree species are white spruce, trembling aspen, balsam poplar and white birch, although black spruce, tamarack, balsam fir and jack pine may also be present.

Small Stands of Deciduous Trees

Composed mainly of trembling aspen and willow, these are typically found in the areas of intensive agriculture in the southern portion of the Basin.

Grasslands

Grasslands, found mainly in uncultivated pastures and along valleys and tree groves, are dominated by blue grama, speargrass, little bluestem, June grass and wheat grasses. Grassland habitat provides nesting and foraging cover for many species of birds and mammals. A high frequency and intensity of grazing can reduce the quality of grassland habitat for some species of wildlife, and improve the quality of the habitat for other species.

Cropland

This monoculture generally provides limited habitat for wildlife. A few species may use cropland when it is fallow or in stubble, and others such as migrating waterfowl will utilize cropland for foraging. Tame forage can provide more breeding and foraging habitat for wildlife, but this upland habitat is also relatively uniform in structure and relatively few species utilize it for breeding. Harvesting of hay crops can often kill ground-nesting wildlife and destroy their eggs.

4.1.3 Extent and Distribution of Habitat

Wetlands

According to LANDSAT satellite imagery (1994), wetlands covered 250,000 hectares (617,5 00 acres). The estimated number of wetland basins with surface water in early May has varied from approximately 350,000 in drier springs, to approximately 700,000 in wet springs (Canadian Wildlife Service and United States Fish and Wildlife Service aerial surveys). The most common basin wetlands are temporary wetlands (33 per cent) and seasonal wetlands (53 per cent). However, many of these may be dry in years with poor spring runoff.

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The distribution of wetlands varies throughout the Basin. Relatively fewer wetlands occur in the northwest portions of the Basin between Buchanan and Fishing Lake, in the northern portion of the Basin just north of Sturgis, and in some areas immediately east of Lake of the Prairies. Greater numbers of wetlands occur in the areas along the northern edge of the Basin, south of Yorkton, and from Wroxton to the southern edge of the Basin.

The reasons for differences in wetland distribution are related to topography, slope aspect, local climate and soil characteristics. In addition, human activities have impacted wetland distribution through activities such as land drainage and wetland consolidation.

Uplands

Within the Basin the most abundant upland cover is cropland (69 per cent), followed by woodland (13 per cent), native grassland (eight per cent) and native grassland used for pasture (seven per cent). Hayland is relatively uncommon (three per cent). (Source: Canadian Wildlife Service Ground Survey)

The distribution of native vegetation varies. Significant areas of wooded vegetation occur along the Assiniboine River valley, along the shores of Lake of the Prairies, along the southern fringe of the Duck Mountains, in the forest fringe along the northern portion of the Basin north and west of Lady Lake, and in the region between Good Spirit Lake and Fishing Lake. Aspen groves are found throughout the Basin. Larger areas of native grasslands and shrubs are located in the western part of the Basin in the Beaver Hills and along the Whitesand River.

Wildlife Populations

The Basin supports about 240 bird species, 50 mammal species, three reptile and five amphibian species.

The Basin is an important waterfowl production area for prairie Canada. The diversity of wetland types, abundance of permanent wetlands, and more stable water conditions compared to more southerly regions, allow for more consistent waterfowl production. Waterfowl populations have fluctuated over the last 40 years depending on the availability of water. Total duck population varied from approximately 200,000 in the dry late 1980s to more than 800,000 in the late 1970s when water conditions were good. The 1990s were also a wet period in which the total duck population numbered about 600,000.

Endangered, threatened or rare species of wildlife are not common in the Basin. However, there are several species of wildlife which are vulnerable to both human and natural disturbances because of their localized breeding distribution. These include the black-crowned night heron, American bittern, sandhill crane, yellow rail, Franklin's gull, common tern, Forster's tern and black tern. These all use wetlands and lakes for breeding and foraging. The yellow-throated vireo and golden-winged warbler may occur in small numbers in woodlands in the eastern portion of the Basin. The red-sided garter snake may occur along the major waterways and forage in riparian habitat and adjacent wetlands.

A healthy riparian zone

4.1.5 Issues

A major issue affecting habitat and wildlife in the Basin has been identified.

Issue:

Wetlands and uplands in the Basin are important and should be protected. The continued removal and degradation of the uplands associated with wetlands and riparian areas will place wildlife at risk.

The importance of individual wetlands must be assessed in the context of its neighbouring wetland and upland habitats.

Wetland numbers, their characteristics and the vegetation around them vary over time in response to moisture conditions. These changes in wetland habitat result in changes in their use by different species of wildlife. Some species disperse to other areas to breed, others remain but breed in adjacent but less secure habitats, and others do not breed until suitable conditions return.

Incremental loss of wetland habitat, wetland margins or upland grassland, shrub or tree cover also has an impact on wildlife. This loss is almost impossible to measure or quantify in terms of the species affected and numbers of individuals displaced or lost. However, the aggregate of all habitat losses within the Basin, as well as those upland and wetland habitats that have been permanently altered or fragmented, has resulted in less wildlife over the long term. The capability of the land base in many cases has been altered to the extent that no wildlife can be produced or live in those areas. There may be periodic increases of species such as white-tailed deer or Canada goose, but over the long term, the habitat capable of sustaining these and many other species is declining.

Some plant and animal species may be more vulnerable than others to loss and alteration of wetlands. Some species may be able to adapt, at least for a short period of time, through dispersal or use of other types of habitats. The removal or degradation of upland habitat, such as slough margins and riparian woodlands can also affect wildlife which use wetlands.

If the health of the landscape is indicated by its biological diversity, continued degradation and loss of wetlands will be an effective barometer.

Factors Influencing Habitat Loss

Many land use activities can impact wetlands and uplands and associated wildlife. Among these are agricultural activities such as burning, clearing, drainage, filling, grazing and haying, and other activities such as road building. Each of these actions can have a major impact on wildlife, particularly when the habitat is irrevocably lost. In an effort to succeed, an agricultural producer must manage the

land base to achieve its maximum agricultural potential. New agricultural technologies continue to make production more efficient. Although this is beneficial to the producer, it is not a complete solution. Land use is constantly changing as conditions that affect agriculture change. For example, Statistics Canada information reveals that the average farm size in the Basin increased from 404 acres in 1956 to 854 acres (164 to 346 ha) in 1996. Over the same period, the rural population declined from about 57,000 to 23,000.

Agriculture policies have had a great impact on land use and agriculture practices within the Basin. The intent of many earlier agricultural programs was to enhance farm income by providing financial support to producers growing grains, oilseeds and more recently, specialty crops. By strengthening these crop sectors, support programs favoured cultivation over other land uses. In recent years, governments have moved to a 'whole farm' approach for income support programs. These more recent programs have little effect on land use decisions made by the agricultural sector. The adoption of environmentally friendly agriculture policies could have an enormous impact on the long-term land use in the Basin.

Agriculture policies have had a great impact on land use and agriculture practices within the Basin.

Roadways, and to some extent railways, have altered the natural drainage patterns within the watershed. Roadway ditches are being used as waterways and their presence has encouraged drainage of adjacent wetlands.

The Rate of Habitat Loss

A study by Ducks Unlimited in 1995 found that for an area near Yorkton, the average loss of wetlands was 45 per cent since the 1950s. A second study by DU in 1999 concluded that most change to wetlands had occurred prior to 1981 in the intensively drained areas, and that more recent efforts by landowners in these areas were focused on improving or maintaining existing drainage works.

A 1994 Sask Water study of a township near Langenburg found that in 1957, wetlands occupied 16 per cent of the township, and bush and uncultivated areas occupied 42 per cent. By 1989, wetland area had been reduced to seven per cent and unimproved area had decreased to 14 per cent.

Canadian Wildlife Service annual surveys indicate that most temporary wetlands are cultivated and the margins of semi-permanent and permanent sloughs are highly disturbed.

Conclusion:
In some areas, an average of 45 per cent of the wetland area has been removed. Temporary and seasonal wetlands are the most impacted by agricultural activities. In some areas, up to 75 per cent of the temporary wetlands and up to 80 per cent of their margins were cultivated.

4.1.5 Issues

A major issue affecting habitat and wildlife in the Basin has been identified.

Issue:
Wetlands and uplands in the Basin are important and should be protected. The continued removal and degradation of the uplands associated with wetlands and riparian areas will place wildlife at risk.

The importance of individual wetlands must be assessed in the context of its neighbouring wetland and upland habitats.

Wetland numbers, their characteristics and the vegetation around them vary over time in response to moisture conditions. These changes in wetland habitat result in changes in their use by different species of wildlife. Some species disperse to other areas to breed, others remain but breed in adjacent but less secure habitats, and others do not breed until suitable conditions return.

Incremental loss of wetland habitat, wetland margins or upland grassland, shrub or tree cover also has an impact on wildlife. This loss is almost impossible to measure or quantify in terms of the species affected and numbers of individuals displaced or lost. However, the aggregate of all habitat losses within the Basin, as well as those upland and wetland habitats that have been permanently altered or fragmented, has resulted in less wildlife over the long term. The capability of the land base in many cases has been altered to the extent that no wildlife can be produced or live in those areas. There may be periodic increases of species such as white-tailed deer or Canada goose, but over the long term, the habitat capable of sustaining these and many other species is declining.

Some plant and animal species may be more vulnerable than others to loss and alteration of wetlands. Some species may be able to adapt, at least for a short period of time, through dispersal or use of other types of habitats. The removal or degradation of upland habitat, such as slough margins and riparian woodlands can also affect wildlife which use wetlands.

If the health of the landscape is indicated by its biological diversity, continued degradation and loss of wetlands will be an effective barometer.

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4.1.6 Options

Public awareness of the importance of wetland and upland habitat is critical to their conservation and to the continued existence of the many species they support. The following option has been suggested as a method of achieving that goal. A number of approaches to achieving this option are suggested.

Option:
Promote increased public awareness of the importance of wetland and upland habitat.

There should be local involvement and agency support to promote a balanced view to the general public of the important role wetlands play in agriculture, rural living and the environment. Economically sound agricultural alternatives to drainage could also be developed to demonstrate how sustainable agriculture works with the environment. There should also be a positive recognition of the conservation costs borne by a farmer in working around wetlands.

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The public should be more aware of the opportunities offered through a variety of wildlife programs. Local involvement with various wildlife agencies could increase knowledge of these programs, which may lead to financial and technical assistance for farmers to make the goals of habitat conservation affordable.

One example is the North American Waterfowl Management Plan (NAWMP), an international agreement between the federal governments of Canada, USA and Mexico to restore and maintain continental waterfowl populations to the average levels observed in the 1970s. While waterfowl are the target species for much NAWMP activity, the mandate has broadened to include multi-species benefits. Ducks Unlimited Canada was selected as the lead agency to deliver the majority of the NAWMP program in Canada. Other NAWMP partners include: Saskatchewan Wetlands Conservation Corporation, Environment Canada, Manitoba Habitat Heritage Corporation, Manitoba Conservation and Saskatchewan Environment and Resource Management.

NAWMP programs (Prairie CARE) target the pothole region of prairie Canada and the northern USA. These programs include agriculture extension, wetland restoration and development, habitat lease or purchase, conservation easements and grassland restoration.

Implementing alternatives to drainage requires assistance. Funding programs to retain wetlands, obtaining technical advice and undertaking region-wide planning are needed to achieve meaningful goals. Agricultural land management systems that support economic development and maintain wildlife habitat should be promoted. Some examples of alternative land use include managed grazing systems, forage production and cultivation of crops that combine economic potential and soil protection with cover for nesting birds and other wildlife.

As a rule, farmers voluntarily adopt conservation practices that improve, or at least do not diminish, the economic status of their operations. The widespread acceptance of conservation tillage is an example of such a practice. In other cases, the methods and technologies needed to protect natural resources are not yet available and require research to make them practical and cost-effective for farmers.

The societal benefits of protecting our water resources should lead to cost-sharing agreements between governments and farmers to make the goals of water stewardship affordable. Interest and support for on-farm planning could be explored. An on-farm plan developed by a landowner with assistance from agriculture and wildlife specialists could be used to encompass a broad range of environmental management measures that could provide assurance to the landowner that specific development practices are practical, sustainable and acceptable. This may assist the landowner in allaying the suspicion that environmental concerns will tend to override the landowner's interests.

Recommendation

- **Information and extension programs should be developed to increase awareness of the importance of wildlife habitat in the Basin as well as the opportunities to implement land use activities that will benefit both agriculture and wildlife.**

Semi-permanent wetland

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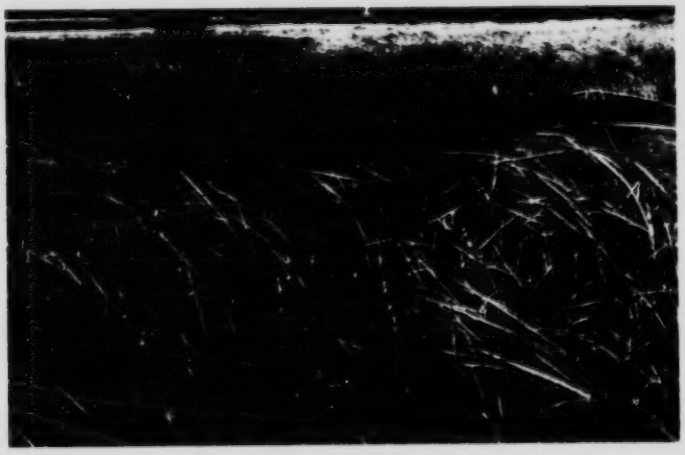

Semi-permanent wetland

4.2 Land Development and Social Considerations

Wetland and upland native vegetation provide benefits for wildlife, soil conservation and water quality. The importance of retaining these habitats should be carefully understood and considered in plans for rural and urban land development. Agricultural interest in further land development should also be recognized. Common approaches are needed to enable agricultural and conservation interests to work together to identify land areas that can be further developed and those which should be retained, enhanced or restored for conservation purposes.

Conclusions:

Wetlands and native uplands provide a source of domestic water, livestock watering and forage, recreational activities, and non-consumptive uses such as hunting, trapping, fishing and ecotourism.

Wetlands help to control erosion, and also recycle, immobilize and concentrate nutrients.

Producers see wetlands as an additional liability because no financial incentive is provided to them to retain the wetlands for conservation benefits.

Numerous costs to individuals and society can result from the removal of wetlands. Besides providing habitat for many plants and animals, wetlands play important roles in water purification, flow stabilization, flood control, and in some situations, groundwater recharging. Wetlands recycle, immobilize and concentrate nutrients, which are essential to increased biological activity and productivity. The wetlands and associated plant communities are prime habitat for invertebrates which form the base of a wide, complex food web.

Wetlands also provide areas for livestock watering and wild hay production, a source of domestic water, and non-consumptive uses such as recreational activities, hunting, trapping, fishing and tourism.

Although landowners are the recipients of some of these benefits they also regard wetlands as liabilities, indicating that removing the wetlands can provide them with several benefits. They point out that removing wetlands and bush reduces the effort needed to farm around obstructions, reduces the over-application of chemicals, reduces fuel consumption and costs, and reduces salinity and weed problems adjacent to wetlands. Draining wetlands enables earlier seeding and thus earlier harvesting, which in turn reduces the potential for crop damage and losses from waterfowl attracted during fall migration.

Some landowners voiced concerns about the amount of wildlife habitat that has been secured within the Basin by government and non-government agencies. They are of the viewpoint that too much habitat has been secured, that agencies have unfair advantages because of larger financial resources and are paying above market value for land, and are removing productive farmland from agricultural use.

4.2.1 Issues

To achieve a common agricultural and conservation land management approach, two issues need to be addressed:

- the economic and social considerations associated with wetlands and agriculture should be better understood, and
- conflicts between land use for agriculture and wildlife habitat should be resolved to give better direction for water management.

Issue:
The economic and social considerations associated with wetlands and agriculture should be better understood.

A conservation ethic among farmers can be fostered through a combined agricultural and environmental government departmental effort to understand and work towards practical common approaches to the social and economic considerations for land development in the Basin. Greater emphasis should be placed on community approaches to solving land and water management problems. These actions could bring about harmony between the interests of farmers and environmental protection in a more holistic way and better define sustainable agriculture.

Issue:
Conflicts between land use for agriculture and wildlife habitat should be resolved to give better direction for water management.

Water and wildlife are Crown-owned natural resources. However, conflicts can arise between agriculture and conservation interests when these resources are located on private land. Approaches are needed to enable these diverse interests to work together to resolve conflicts in order to achieve their respective goals.

Development of a practical conservation ethic is needed to make progress towards sustainable agricultural practice and sustainable natural ecosystems. The role of water in the natural environment should be properly valued by the agricultural industry and other users in the rural landscape.

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Planning for wetland drainage should recognize the importance of retaining a complex of wetlands with a variety of wetland habitats on the landscape. Because of the variability in landscape conditions, and the surrounding habitat complex, it is very difficult to provide a simple description of which wetlands can be modified with the least environmental effects. Criteria should be developed for classification of wetlands, identification of environmentally sensitive areas and mitigation for lost habitat. Identification of environmentally sensitive areas is necessary as a basis for directing a variety of programs, including compensation where off-farm drainage is proposed.

As specific land management plans are developed, work would be needed to document remaining wetland and upland habitats and their importance in the watershed and region. This more detailed classification can be done at the smaller scale to provide direction. A practical way to help identify the remaining habitat that could be protected along with the land for various agricultural uses would be to identify land use in a watershed plan developed with local involvement.

Information is available on topography, hydrology, soils, and lands which have some level of conservation protection. Participants in developing a watershed plan can use this information to better develop an understanding of the resources, and to identify desired directions for development and conservation. The result would be a plan that would identify areas more suited for certain types of development and lands which would be deemed important for some level of conservation management.

A proposed plan for off-farm drainage which impacts wetlands, or channelization in riparian habitats, should include mitigation. Mitigation may involve retaining, improving or restoring habitat to compensate for habitat that may be lost in developing a project that involves land drainage and/or clearing. Including mitigation in a land development plan would be applicable at both small scale (individual farm) and a larger scale proposal (watershed level).

Recommendation

- **Criteria should be developed to assist landowners in planning and resource managers in evaluating and approving proposed wetland drainage and upland habitat removal.**

4.2.2 Options

Three options are identified to assist landowners in achieving agricultural and conservation interests:

- identify important wildlife habitat in a watershed plan and develop partnerships to enable conservation of habitat;
- provide landowners with information on wildlife damage prevention practices and compensation programs; and
- develop a program to manage nuisance beavers.

Option: Identify important wildlife habitat in a watershed plan and develop partnerships to enable conservation of habitat.

Participants in the Unauthorized Drainage Workshop commented on several occasions that retention of water and wetlands would more likely occur if there was a mechanism to provide income from that land for the agricultural industry. It was also suggested that funds directed toward carbon offset should be made available to support the maintenance of wetlands. Further changes to the land tax process would provide some additional incentive to retain wetlands rather than drain them. Also, a 'catalogue' of wetlands should be created that shows lands that are, or could be, prioritized for conservation and for any future carbon offset programs.

Retention of water and wetlands would more likely occur if there was a mechanism to provide income from that land for the agricultural industry.

Currently, Manitoba and Saskatchewan legislation enables approval of drainage works on a case-by-case basis. There is no current mechanism other than the shoreland alteration permit (Saskatchewan) to regulate removal of riparian habitat and other native upland habitat. This permit is also based on a case-by-case application and does not usually take into consideration the larger area.

In Manitoba, approval is required for on-farm and off-farm drainage. In Saskatchewan, an approval to drain wetlands is required if the water would leave the landowner's property. Approval is not required for drainage and consolidation of wetlands within a landowner's farm unit. Mechanisms that could encourage and support conservation of wetlands and wildlife habitat in developments on farms are education, extension, and compensation programs. For off-farm development proposals, programs could include compensation, mitigation, and enforcement.

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Two areas in the Basin with different issues and land use interests could be selected for pilot projects in watershed planning. For example, one area could be the Lower Assiniboine River watershed where some landowners have expressed interest in undertaking considerable land development. A second pilot project could be initiated in an area where there are expressed interests in undertaking different land management, cropping practices and conservation measures. These projects should be initiated as soon as possible. Areas for consideration are the Yorkton Creek watershed and the Upper Whitesand River watershed.

Recommendations

- **Watershed plans should be developed as a basis for identifying lands for development and lands for conservation purposes. Considerations for developing a watershed plan are presented later in this report in Chapter 7.0, Local Watershed Management.**

- **A planning and approval process should be developed to support landowners and government resource management agencies in determining appropriate levels of development. This approach would involve developing a watershed plan which would identify lands for development or conservation. Approval to drain wetlands and clear native riparian and upland habitat would be based on this watershed plan.**

Option:

Provide landowners with information on wildlife damage prevention practices and compensation programs.

Wildlife damage compensation programs are available in Manitoba and Saskatchewan. Activities should be undertaken to ensure that landowners are aware of available compensation programs and who to contact regarding damage claims. Information should be provided to landowners with details on land management and crop damage prevention practices that could reduce the potential for crop loss and damage.

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A local committee could provide an opportunity for landowners, municipal councils and others to identify and participate in planning and implementing waterfowl crop damage prevention programs. For example, a public advisory committee was formed in the Wadena-Quill lakes region. Some of the municipalities that have participated in this program report good experiences. Implementing similar public advisory committees in the Basin could be explored.

Recommendations

- **Landowners should be provided with information on wildlife damage compensation programs and prevention practices.**
- **Landowners in the Basin should consider organizing local public advisory committees to develop and promote local crop damage prevention programs.**

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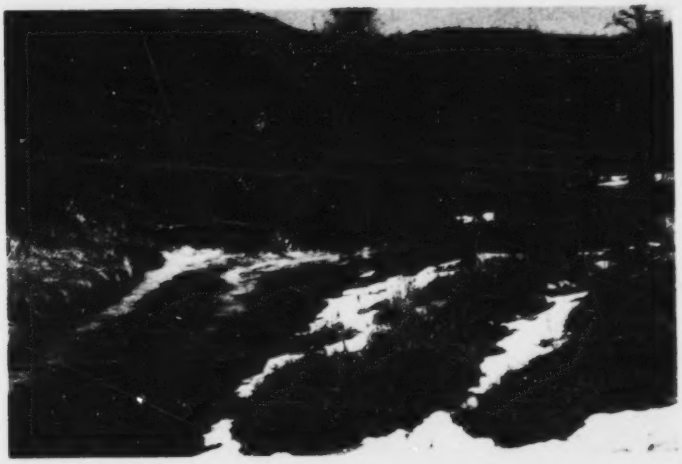
Option:
Develop a program to manage nuisance beavers.

The Local Watershed Committees strongly support the development of a beaver control program that would be implemented on a long-term basis in the Basin. Prior to any program implementation, provincial beaver management strategies are needed in Saskatchewan and Manitoba that identify a responsible agency and provide for adequate funding. Appropriate policy and legislation amendments may be required to support these strategies. Specific problem areas in the Basin could be identified in which local governments and resource management agencies would work together to target management efforts.



Beaver dam

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The Local Watershed Committees strongly support the development of a beaver control program that would be implemented on a long-term basis in the Basin. Prior to any program implementation, provincial beaver management strategies are needed in Saskatchewan and Manitoba that identify a responsible agency and provide for adequate funding. Appropriate policy and legislation amendments may be required to support these strategies. Specific problem areas in the Basin could be identified in which local governments and resource management agencies would work together to target management efforts.

Beaver dam

Recommendation

- **Beaver management programs should be developed. Specific problem areas should be identified. Local governments and resource management agencies should work together to target management efforts.**

5.0 Water Supply and Use

Issues related to water supply and use in the Basin were reviewed by the Water Supply and Use Committee. This section summarizes the findings and conclusions of the Committee and lists issues and options it has identified. For a more detailed discussion, please refer to Appendix B: "Water Supply and Use Committee Report."

Two key objectives to address water supply and use in the Basin have been identified:

- surface water and groundwater resources should be managed to sustain long-term use; and
- instream flow needs should be included in surface water management to sustain aquatic life.

5.1 Surface Water and Groundwater Supply

All communities in the Basin should have access to an adequate and safe domestic water supply.

There are concerns locally, regionally and basin-wide, that there may not be enough good quality water to meet the needs of existing and future developments. It is feared that uncertainty of water supply may mean water shortages and limits to economic growth. The expected expansion in livestock production will require a dependable supply of good quality water. Attraction of new economic development may be hindered because of insufficient quantity and/or quality of water supplies.

Water users in the Basin are responsible for ensuring the availability of adequate supplies of good quality water to meet their needs. Communities will need to develop detailed aquifer management plans as their current sustainable groundwater supply approaches the limit for further growth. Provincial and federal governments may provide information, technical assistance or programs to help water users secure a water supply to meet their needs.

5.1.1 Issues

Two issues concerning water supply in the Basin were identified:

- surface water supply may not be adequate to meet future water demand, and
- groundwater demand could exceed the sustainable groundwater supply.

Issue:
Surface water supply may not be adequate to meet future water demand.

Total annual surface water use in the Basin is approximately 53,000 dam^3 when wildlife conservation projects are included, representing approximately 13 per cent and 17 per cent of the mean annual and median annual natural runoff volumes for the Basin respectively. This represents approximately 75 per cent of the lowest annual volume on record (about 74,000 dam^3 in 1961). Apportionment is not an issue in the Basin at this time.

Conclusions:

At both the current and future level of water use, surface water supply is generally sufficient, although it is less reliable in the headwaters of the Basin. As with all prairie areas, the Basin is subject to droughts.

Apportionment between Saskatchewan and Manitoba is not an issue in the Basin at the present time or in the foreseeable future.

There is no reliable method to determine the effect of drainage or climate change on the supply and use relationship.

A mathematical water management model was constructed to examine the state of surface water supply and the major water uses on a mean monthly basis (Appendix B). The analysis revealed that, at both the current and future level of water use, surface water supply is generally sufficient, although somewhat less reliable in the headwaters of the Basin and subject to droughts. A preliminary analysis of instream flow requirements suggests that water is generally available for aquatic ecosystems and offstream uses, but during periods of low flows there may be conflict with other water uses.

Detailed site-specific analysis of water availability and quality is still required when considering the potential of meeting the water needs of individual projects. Some attempts are being made to show strictly physical water availability on a map using GIS technology. Current products only show generalized water availability and ignore water quality and the variability of surface water supply. These applications are very general and cannot be applied to specific areas or uses. Such approaches may prove useful in the future, with better data and further refinement.

Issue:

Groundwater demand could exceed the sustainable groundwater supply.

Public concern with overall aquifer management, including water use and aquifer protection, and aquifer recharge has been identified.

In the Yorkton area, groundwater demand is approaching the limit of the availability supply from the aquifer. The Yorkton Aquifer System is large and has a significant number of users relying on it for water. An aquifer management plan is under way in the area.

Currently, there are no other large aquifers or aquifer systems in the Basin known to be under similar stress but because of insufficient data, this is not known for certain. However, there are a number of smaller aquifers which could be near their sustainable limit and may need some type of management plan in the future.

The lack of basic technical data and/or resources necessary for aquifer management precludes a broad and comprehensive understanding of the Basin groundwater resource and its ability to provide water. Issues such as the sustainability of uses, artificial recharge, recharge areas, aquifer protection and, ultimately, supply must be examined.

Conclusion

No aquifer management plans other than the one currently being developed for the Yorkton aquifer system are contemplated, although additional developments may make them necessary.

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Conclusion

No aquifer management plans other than the one currently being developed for the Yorkton aquifer system are contemplated, although additional developments may make them necessary.

5.1.2 Options

Two options have been identified relating to water supply management concerns:

- develop an inventory of surface water and groundwater resources considering existing and potential future water demands, and
- determine importance of wetlands with respect to groundwater recharge.

Option:
Develop an inventory of surface and groundwater resources considering existing and potential future water demands.

Total annual water use in the Basin is estimated at approximately 64,000 dam^3, of which roughly 80 per cent is surface water and 20 per cent is groundwater.

Surface water use is primarily reservoir evaporation, wildlife conservation projects, agricultural uses (irrigation, livestock, crop spraying and some rural domestic use), and about 20 per cent of municipal uses. Groundwater supplies the remaining 80 per cent of the municipal uses, most of the industrial uses and much of the rural domestic use.

Total water use in the Basin is projected to increase by five per cent by 2010 and seven per cent by 2020, barring any major water use developments. Methods and assumptions used in the Study to estimate existing and future water use are presented in the Water Supply and Use Report (Appendix B).

Surface Water

There is no immediate need to examine specific surface water supply scenarios or to alter the current approach to surface water supply management. A preliminary surface water availability analysis for any proposed new use can be conducted using existing procedures and the results of the Water Supply and Use Committee's work. Proposed new uses require a detailed site-specific analysis of water availability and effects on other uses. Surface water supplies should continue to be allocated subject to water availability and downstream demands. Instream flow needs should be considered when granting allocations and operating reservoirs.

Groundwater

A more pro-active approach to groundwater management should be taken. This may include numerous items such as geological and hydrogeological mapping, aquifer characterization, resource analysis, aquifer monitoring and groundwater allocation requirements to fill in key gaps on groundwater maps. Efforts should also be made to improve the timely analysis of existing data where warranted.

Other than for the Yorkton aquifer, no further aquifer management plans are currently envisioned in the Basin. However, that could change at any time with additional use. Management of groundwater resources in the Basin is reliant on the regulatory process.

Water management in the Basin would benefit from improved integrated data collection, management and analysis. This would include such items as:

- the proportion of surface water and groundwater used by agriculture, particularly rural domestic use;
- actual water use data for irrigation and industrial uses;
- basic water supply data for both surface water and groundwater;
- water quality data; and
- instream habitat data.

Option: Determine importance of wetlands with respect to groundwater recharge.

The role of specific wetlands with respect to groundwater recharge in the Basin is unknown. The following is a general discussion of the theoretical role of wetlands in hydrogeology.

At the local scale, wetlands are typically part of very localized groundwater flow systems with water levels connected to local water tables. Groundwater flow, therefore, may be in or out of any particular wetlands, depending on the position of the wetland in the landscape as well as seasonal and long-term climatic conditions. Evapotranspiration around wetlands is commonly replenished by shallow groundwater and only a small amount of wetland water enters larger, regional groundwater flow systems. In this situation, drainage may result in lowering the shallow water table locally.

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Currently, there is no work being done specifically related to determining the role of individual or groups of wetlands on groundwater in the Basin. Furthermore, there is no information available about the infiltration effects of chemicals applied to the landscape on the groundwater. Unless specific information is available for a particular parcel of land, a conservative approach may be one which encourages landowners to use land management practices that have a positive effect on the availability of good quality water.

Research is needed to obtain a better understanding of the interrelationships between wetlands and groundwater in the Basin. Local Watershed Committee members suggested that research should include the relationship between wetlands and salinity. The cost of such research could be justified by effective groundwater management which would lead to protection and better use of the resource. Research could be undertaken to identify the groundwater resource characteristics. On this basis, a monitoring network may be established to collect data to understand the relationship between wetlands and groundwater.

Wetlands are important for aquifer recharge

5.2 Infrastructure

Water supply often has as much to do with getting water to where it is needed as it does with the actual amount of water available. The infrastructure used to move, store, or treat the water requires resources and adds economic and environmental dimensions to the problem. Securing groundwater sources often involves exploration with an element of risk, and if successful, there are costs to move and perhaps treat the water.

5.2.1 Issue

Issue:

The current and future ability to make good use of available water may be limited by the state or scale of the necessary infrastructure.

There are concerns that the water supply infrastructure in some communities within the Basin requires maintenance or updating. The deteriorating condition of the Sturgis Weir is one example. There is general concern with the potential accelerating effect of drainage on siltation of water bodies. At Kamsack, the concern is about increased silt accumulation reducing the water quality and the available storage volume in the reservoir.

Interest in expanding infrastructure, such as water supply projects, also exists. While new infrastructure may be able to provide water of better quantity or quality, any concerns about the projects are likely with the economic and financial feasibility, rather than the technical feasibility of maintaining or improving infrastructure.

There is local interest in rural water distribution systems. Where there are areas of water shortages, poor water quality, or where individual water sources are costly, rural distribution systems from a central source are an option. For example, some First Nations are concerned about the Assiniboine River water quality and are interested in alternate sources.

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5.2.2 Options

Two options have been identified to address limitations on water supply imposed by inadequate infrastructure:

- rationalize and improve existing water infrastructure; and
- improve programs to assist rural areas in securing domestic water supplies.

Option: Rationalize and improve existing water infrastructure.

There are existing works in need of maintenance or upgrading in order to provide a continuous, reliable and safe supply of water. In areas where only poor quality surface water or groundwater is available or the supply less dependable, remedies may include storage and transport of higher quality water and/or the application of new treatment technologies, or turning to alternate sources of water. For example, because of severe water quality problems, the Town of Canora developed a new groundwater source to replace its surface water source (Whitesand River).

The protection of current water supplies must be ensured. Rural water distribution systems can be promoted as a drought-proofing measure provided there is sufficient information to indicate that the source of water supply is reliable. As well, local organizations are better able to seek out and negotiate any government financial and technical assistance for rural water distribution systems versus individual systems. There is the potential for rural water distribution systems in the Yorkton north and Buchanan areas.

Recommendation

- **The infrastructure must be examined to determine necessary improvements to secure safe and reliable community water supplies. Local initiatives may need government assistance to:**

  - technically evaluate (e.g., usefulness, effectiveness, structural integrity) existing infrastructure such as weirs, dams and raw water treatment and distribution facilities;
  - develop plans for sustainable community or rural water supply infrastructure alternatives;
  - estimate the full costs (e.g., operation, maintenance, depreciation and replacement);
  - identify local concerns over costs that are an impediment to upgrading or making improvements; and
  - repair or remove water supply and treatment facilities.

Option:

Improve programs to assist rural areas in securing domestic water supplies.

Once plans have been developed to maintain, upgrade or otherwise improve the infrastructure, rural areas may need assistance in securing a safe and reliable water supply.

Currently, community and rural infrastructure needs are supported independently by various provincial and federal agencies. Existing programs should be jointly reviewed for effectiveness in meeting these needs and to ensure drought proofing. A "one-stop shopping centre" would help make it easier to understand all the programs that are available.

A long-term cooperative approach should be developed to address deficiencies and constraints in water supply infrastructure such as wells, pipelines and dugouts. Water distribution systems that increase availability in water-short areas are in demand in the Yorkton and Buchanan areas of the Basin. Water treatment technology that can increase the availability of good quality water may be needed. Local Watershed Committees suggest that a coordinated approach to program delivery and funding should be taken by municipal, provincial and federal agencies to make effective use of public funds. Local involvement may have a role in water supply management over a larger area to enable local funding partnerships to be created. Locally prioritized project improvements could be made while retaining local control over them.

Installing a rural water supply

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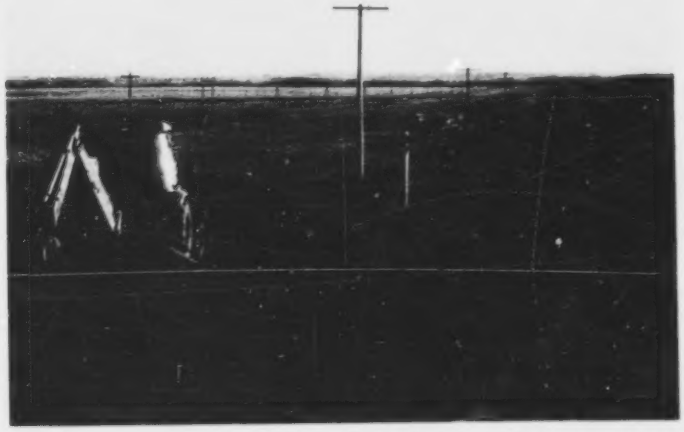

Installing a rural water supply

5.3 Instream Needs

Healthy habitat for aquatic life requires a certain amount and timing of streamflow in order to survive. Today, in contrast to the past, instream flow needs are being considered as an integrated component of surface water management due to intensified development pressures over the past 60 years. This is an emerging consideration that recognizes the existing level of land and water development. Water supply planning for potential economic growth should consider fisheries instream flow needs.

5.3.1 Issue

Issue:
Land and water management practices are affecting fish habitat.

Fish habitat may be affected either directly or indirectly by a variety of land and water management practices. Water storage and diversion works, such as dams and water intakes, affect the availability of water for instream uses by aquatic organisms, including fish. Fish need adequate amounts of water at appropriate times of the year for spawning, rearing and overwinter survival. Overbank flooding in the spring is needed for successful spawning by species such as northern pike.

Conclusion:
The preliminary analysis suggests that sufficient water is available for instream flow needs (aquatic ecosystems) and offstream uses, but during periods of low flows there may be conflicts over water use.

The preliminary analysis of current instream flow needs suggests that water is available for aquatic ecosystems and off-stream uses, but during periods of low flows there may be conflict. Instream flow requirements should be determined for all streams before water is fully allocated for off-stream uses.

Stream channelization removes critical habitat such as spawning riffles, instream cover and deep pools. This reduces habitat diversity, which in turn reduces diversity and productivity of aquatic biota. Channelization and other physical disruptions of streams must be minimized to preserve adequate amounts of aquatic habitat. Where physical disruptions cannot be avoided, mitigation or compensation must be conducted to ensure no net loss of aquatic habitat.

Changes to the flow regime resulting from land use changes and wetland drainage affect aquatic habitat. These can be ameliorated to some degree by developing riparian buffers, limiting wetland drainage and re-establishing wetlands where practical. Conversion of treed land to cropland and drainage of sloughs increases the magnitude of flows. Higher flows increase instream erosion with the resulting sedimentation covering important stream habitat for fish and other aquatic life.

Dams, weirs and improperly constructed road crossings block fish migrations, disrupt the life cycle of fish, limit their range and reduce biodiversity.

5.3.2 Options

Two options for promoting a healthy aquatic habitat are:

- ensure instream flow needs are considered when granting water allocations; and
- remove barriers to fish migration.

Option:
Ensure instream flow needs are considered when granting water allocations.

Ideally, an unregulated river and completely natural flows are desirable for aquatic ecosystems. During periods of low flow, water diverted for off-stream use could impact the aquatic ecology. On the other hand, the operation of the reservoirs in the Basin has augmented the minimum flows to some degree.

Instream flow guidelines for the major reservoirs should be established with due consideration for other uses. Local Watershed Committees suggest that any instream flow recommendation be pragmatic with a balanced approach to enable resolution of situations where existing water use priorities conflict with instream flow needs.

The implications of instream flow needs on the apportionment agreement between Saskatchewan and Manitoba are currently under review by the Prairie Provinces Water Board.

Recommendation

- **Instream flow needs should be considered in future water management, particularly reservoir operation and when granting water allocations.**

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Option:
Remove barriers to fish migration.

Construction of dams, weirs and road crossings has resulted in complete or partial blockages of fish spawning migrations at several locations in the Basin. The Kamsack Weir is the only water control structure in the Basin that is equipped with a fishway.

With government assistance, a local watershed association could be involved in identifying and improving existing infrastructure such as road crossings and weirs that are posing a critical disruption of fish spawning migrations. Existing Fish Habitat Protection Guidelines for water control structures and for stream crossings may be used to rate and recommend modifications to existing structures.

A local watershed association could be involved in developing a program to support local projects that incorporate features to mimic natural stream characteristics such as vegetative buffers, grassed waterways, erosion control and wetlands and marshes, riffles and control structures.

Grassed waterways are not always recognized by farmers for their value. The economics of grass vegetation may need to be demonstrated in conjunction with farm operations. There may be a need to undertake pilot demonstration projects that incorporate the Federal Department of Fisheries and Oceans guidelines in instream works and drainage projects. Demonstration projects could involve innovative designs for low level crossings. Some Local Watershed Committee members expressed interest in low level crossings. This local watershed initiative would require government technical or financial assistance to establish.

Kamsack Weir (fish ladder on right)

Recommendation

- **Infrastructure blocking fish migration should be evaluated and modified to improve fish passage.**

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A local watershed association could be involved in developing a program to support local projects that incorporate features to mimic natural stream characteristics such as vegetative buffers, grassed waterways, erosion control and wetlands and marshes, riffles and control structures.

Grassed waterways are not always recognized by farmers for their value. The economics of grass/vegetation may need to be demonstrated in conjunction with farm operations. There may be a need to undertake pilot/demonstration projects that incorporate the Federal Department of Fisheries and Oceans guidelines in instream works and drainage projects. Demonstration projects could involve innovative designs for low level crossings. Some Local Watershed Committee members expressed interest in low level crossings. This local watershed initiative would require government technical or financial assistance to establish.

Kamsack Weir (fish ladder on right)

Recommendation

- **Infrastructure blocking fish migration should be evaluated and modified to improve fish passage.**

6.0 Water Quality

The quality of the Basin's water resources was assessed by the Water Quality Committee within the context of the identified effects of various activities on water quality (Appendix D: "Water Quality Committee Report"). Existing information was used to address:

- the effects of agricultural drainage on water quality;
- nutrient enrichment of water bodies from municipal effluent;
- nutrient enrichment from livestock access to watercourses;
- trends in water quality; and
- the protection of groundwater from contamination.

A literature review on the effect of activities on water quality was conducted. This review was based primarily on existing information directly related to the Upper Assiniboine River Basin, or where information was not available, the Canadian Prairies or other specific regions. The water quality parameters of concern discussed in the literature review were:

- nutrients (nitrogen and phosphorus);
- dissolved oxygen;
- pesticides, heavy metals;
- turbidity/sedimentation; and
- pathogens.

The information compiled in the literature review was also used for the development of a public information brochure (Appendix V: "Water Quality in the Upper Assiniboine River Basin", Appendix D: "Water Quality Committee Report").

Two objectives were identified to address water quality in the Basin:

- information and supporting data should be made available to enhance public knowledge and awareness of land and water management practices affecting the quality of the Basin's water resources; and
- this information and data should be used to identify measures to protect and enhance the quality of surface water and groundwater resources in the Basin.

6.1 Surface Water and Groundwater Protection

In general, any substance that may enter a water body can be a potential source of pollution. The resulting water quality depends on the type and volume of the pollutant, original quality of the receiving water, its assimilative capacity, level of mixing, rate of water flows, rate of chemical and biological changes during its flow periods, and other specific use requirements. Effluents from sewage treatment facilities, suspended sediments, and nutrients and pesticides in runoff from agriculture and livestock operations are major sources of pollutants. Storm water runoff from towns and cities may be another major source of pollution.

Groundwater is often the sole water source for municipal, domestic, agricultural and industrial needs. Groundwater can be contaminated from a number of sources, including fertilizer and pesticide applications, manure storage and spreading, livestock operations, effluent irrigation, landfills, leaking septic and fuel storage tanks and lagoon seepage. Wells can provide a direct connection for easy introduction of contaminants from the surface to an aquifer. Once an aquifer is contaminated, it is difficult, expensive and time consuming to clean up. Because a contaminant cannot be easily removed from groundwater supplies, prevention is the only effective approach to maintain a safe and clean supply.

6.1.1 Issues

Two issues that have been identified concern the protection of water supplies from contamination and access to a good quality water supply:

- basin residents perceive that groundwater and surface water quality is deteriorating and must be protected by measures such as increased monitoring, and
- rural residents are concerned about access to good quality domestic and drinking water supplies and availability of low cost testing services.

Issue:

Basin residents perceive that groundwater and surface water quality is deteriorating and must be protected by measures such as increased monitoring.

Surface Water

Periodic sampling has been conducted in the Basin as part of specific studies on major water bodies including Fishing Lake, Good Spirit Lake, Whitesand River, Assiniboine River, Shell River, Big Boggy Creek, and Lake of the Prairies. Water supplies and wastewater of towns and cities are also sampled as part of regulated treatment operations.

In addition to these studies, monitoring conducted on the Assiniboine River below Kamsack at the PPWB station near the interprovincial boundary provides the most comprehensive information on the Basin. Water quality data have been collected there on a monthly basis since 1974. Data from this site were analyzed for long-term trends over the past 17 years. The resulting report, "Water Quality Trends in the Assiniboine River at the Interprovincial Boundary", shows no constituent had any significant long-term increasing water quality trend. Long-term decreasing trends were determined for nickel, fecal coliform and alpha BHC. However, variables such as total phosphorus, dissolved oxygen and total manganese exceeded the PPWB water quality objectives, and were identified as a potential concern.

The report, "Water Quality Trends in the Assiniboine River at the Interprovincial Boundary", shows no constituent had any significant long-term increasing water quality trend.

Groundwater

Monitoring of wells for a range of constituents such as pesticides, nitrates, or bacteria contributes to addressing immediate concerns over the protection of groundwater supplies. Contaminants may move slowly through soil, depending on the permeability of the materials. How quickly a contaminant moves through the overlying material to the aquifer can affect how quickly it is detected in a water supply. In the future, regular monitoring of wells should be encouraged and would be a prudent course of action for early detection of potential problems.

Issue:

Rural residents are concerned about access to good quality domestic and drinking water supplies and availability of low cost testing services.

Groundwater is normally the first choice of water supply for rural residents where it is available in sufficient quantity and quality. Groundwater quality is much more uniform throughout the year than is surface water quality, allowing for consistent water treatment where treatment is needed. However, in many parts of the Basin, groundwater cannot supply adequate quantities for domestic wells, or the chemistry of some shallow groundwater supplies makes it unsuitable for consumption. In these areas, many residents depend on dugouts for farm and household use. Dugouts are drought sensitive and prone to water quality problems due to the nature of the runoff which fills them.

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Groundwater protection from man-made sources of contamination may be enhanced through measures such as proper well siting and well construction, sealing abandoned wells, testing well water and taking steps to prevent contamination in recharge areas. Until specific groundwater recharge information is available for a particular parcel of land, landowners should be encouraged to use land management practices that have a positive affect on maintaining good quality water. Where natural groundwater is hard or contains high concentration of sodium or sulphate, home-scale water treatment may or may not be feasible.

If a surface water supply source is used, water quality can be enhanced by protecting the quality of runoff into the dugout or stream. Runoff into dugouts should be filtered by vegetation to minimize sediment and sediment-borne contaminants and nutrients. Livestock should be kept away from dugouts to avoid contamination of the water. In a similar manner, vegetated riparian zones along streams help to maintain stream water quality.

Water quality tests should be conducted regularly on domestic supplies. However, the costs of water quality testing to the individual are in some cases a deterrent to regular water quality monitoring. The onus is usually on the individual to take the sample, request the type of information desired and pay a provincial or private laboratory the full price for analysis. Then, it is up to the individual to interpret the results and to determine a possible course of action. In Saskatchewan, Sask Water has initiated a program to encourage water quality testing of individual rural domestic water supply (including dugouts and wells) for a subsidized fee (currently $100). A technician will sample and arrange for analysis of the raw water for major ions, bacteria, nutrients, physical parameters, trace metals and prepare a report which provides an interpretation of the analysis and advice on treatment.

6.1.2 Option

Option:
Undertake a water quality monitoring program to develop baseline information.

The current water quality monitoring program for the Basin should be reviewed and re-developed to target specific information and analysis needs for adequate protection of the surface and groundwater resource. It may also be designed to support riparian health assessment and inventories.

Surface Water

Levels of dissolved oxygen, total phosphorus and dissolved manganese already exceed the PPWB Water Quality Objective for the Assiniboine River at Kamsack and could potentially have a detrimental effect on downstream users. Monitoring for these variables should continue at a frequency that will enable detection of long-term trends.

A plan for obtaining long-term baseline surface water quality information needs to be developed to complement the data collected at the existing PPWB station. Local Watershed Committees have commented that it is impossible to target problem areas with only one testing station. Furthermore, local people will want to see the cumulative benefits of any local watershed improvement projects on water quality. They suggested adding a station at St. Lazare (outlet for the whole Basin) or just downstream of the Shellmouth Dam. Information collected at strategically placed sampling stations could be used to assess any cumulative changes in land and water management practices on water quality. For example, one or two stations could be established on the Whitesand River which drains an area containing most of the Basin's population.

Baseline surface water quality information collected over a short time period could be used to monitor effects of land and water management activities aimed at improving and enhancing water quality. Water quality information has been sporadic, inconsistent and/or inadequate to evaluate the effects of land management and other developments on water in the Basin. Water quality data have been collected in response to areas of concern and in compliance with regulatory requirements (public knowledge of treated water, wastewater effluent within provincial guidelines). This approach tends to identify damage to water quality after the fact.

Conclusions:
There is little integrated database management among the variety of agencies collecting data. As a result, much of the information regarding groundwater availability and quality is lacking continuity and can be difficult to obtain.

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Questions related to how specific activities affect water quality based on scientific data cannot all be answered. The Study could not respond to the effects of drainage on water quality as pre- and post-project development data do not exist. The Study has relied on the literature research which identifies theoretical negative impacts of various activities on water quality and conceptual measures to mitigate them. Future monitoring may enable assessment of effects of some project enhancements, such as grassed waterway and buffer strips, on water quality.

Landowners could be encouraged to adopt practical project enhancements to help ensure that streams and water bodies meet provincial surface water quality guidelines. Such enhancements applied over a watershed could have a cumulative effect on improving water quality.

Local Watershed Committees have suggested involving volunteers in a stewardship program to instill ownership in becoming part of a solution to improve water quality. This may require government to provide technical support in conducting the testing and analyzing results. Local involvement may help to educate Basin residents and increase awareness of water quality issues and their potential causes.

Groundwater

While some regulations are in place for protecting the vital groundwater resource, monitoring of groundwater, particularly in the most sensitive areas, must be implemented and carried out in order to detect and track any water quality changes. Aquifers could be monitored regularly for possible contaminants such as pesticides and once any areas of concern are identified, long-term monitoring and possible corrective actions may, if practical, be implemented. Without good water quality information, it will be very difficult, if not impossible, to determine water quality trends.

If water analysis was available at a reduced cost, landowners might be more inclined to test their groundwater supplies on an annual or biannual basis. This information can also be used in the development of an overall groundwater availability/water quality database and assist in determining what future monitoring is required.

The Local Watershed Committees identified the need for coordinated collection and distribution of information which should be made available to the public. The various agencies responsible for groundwater information and water quality should be encouraged to share information and develop a joint database of the present status of groundwater and quality. This will require extensive cooperation and sharing of information among the various agencies and a long-term commitment from governments to support the pooling of information.

Recommendations

- **Monitoring for variables that impact water quality should continue at a frequency to enable detection of long-term trends.**

- **Water analysis should be provided at a reduced cost to individuals to encourage landowners to test their groundwater supplies on an annual or biannual basis.**

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6.2 Land and Water Management Practices

Since farmers and ranchers have the most control over land management in the Basin, they have much to contribute in protecting and enhancing water quality in the basin. Cities and towns also play an important role in environmental sustainability through control of point source contamination. There are many other individuals and interest groups such as loggers and cottagers that can also contribute to water quality protection in the Basin.

Protecting water quality is a community, basin-wide concern which should bring together all who have an interest in water quality, including farmers, cities, towns, individuals and other interest groups in the Basin. Governments can also play a key role, mainly by creating and enforcing legislation and regulations, and by designing policies and programs that promote agricultural sustainability considering economic, environmental and social outcomes.

6.2.1 Issues

Six issues concerning water quality affected by land and water management were identified:

- domestic and municipal groundwater supplies need to be protected from contamination;
- chemical container disposal areas and landfill operations are point sources of pollution that can affect surface and groundwater quality. These operations must be properly managed and enforced;
- agricultural drainage from land, sloughs and wetlands can be a non-point source of pollution of surface water. Agricultural runoff may contain increased sediment, nutrients and pesticides;
- algal blooms on Lake of the Prairies are a concern;
- increased bank erosion of streams and rivers diminishes water quality. Increased erosion and sedimentation reduce fish spawning areas and habitat; and
- livestock operations and range management practices deteriorate water quality and impact downstream users.

Issue:
Domestic and municipal groundwater supplies need to be protected from contamination.

Many communities and rural residents rely on groundwater as their sole source of potable water, and they are concerned about the quality of these water supplies and the potential for contamination. Protection of these supplies from the infiltration of agricultural chemicals is of particular concern for shallow wells.

Groundwater quality can be impacted by activities such as fertilizer and pesticide applications, manure storage and spreading, livestock operations, effluent irrigation, leaking septic tanks, landfill leachates and lagoon seepage. Once contaminants enter groundwater supplies, they have the potential to impair the water quality for municipal, domestic, irrigation and livestock purposes. Remediation of contaminated groundwater supplies is often difficult, time consuming and expensive.

Prevention is the only effective approach to dealing with the potential for groundwater contamination. Methods for protecting groundwater supplies include proper well siting and construction, protection from potential contaminants in the recharge area, adopting best management practices to reduce non-point contamination from agricultural sources, monitoring, and the need to properly decommission and seal unused wells.

Although groundwater contamination has been observed at some specific locations within the Basin, it is presently not considered to be a widespread problem.

Issue:
Chemical container disposal areas and landfill operations are point sources of pollution that can affect surface and groundwater quality. These operations must be properly managed and enforced.

Chemical container disposal areas and landfills are potentially significant point sources of pollution in rural areas. An initiative to collect and recycle pesticide containers has been managed by the Crop Protection Institute of Canada for a number of years. Proper chemical container disposal includes triple rinsing the containers, disposal at an authorized, properly designed facility, and recycling of the disposed container in an approved manner.

However, not all containers are discarded in the proper manner. Containers which are improperly discarded in municipal waste disposal grounds or at their point of use, pose a contamination hazard for both surface water and groundwater.

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However, not all containers are discarded in the proper manner. Containers which are improperly discarded in municipal waste disposal grounds or at their point of use, pose a contamination hazard for both surface water and groundwater.

Municipal or private waste disposal grounds or landfills must comply with regulations which govern the type of material which can be accepted. Proper site location, construction and maintenance are required to protect groundwater supplies from leachate and surface water supplies from direct contamination. Older waste disposal areas which do not comply with the current regulations may contaminate groundwater or surface water with agricultural or household chemicals, petroleum products or organic contaminants such as manure or dead livestock. These non-compliant disposal areas include unauthorized on-farm disposal areas. Disposal areas which do not comply must be closed and cleaned up to prevent the migration of contamination through water flows.

Continued public education is needed to increase the recovery rate for chemical containers. This may be combined with incentives such as deposits on the containers, and with enforcement action to prevent improper disposal practices. Public education concerning the need to dispose of containers at approved municipal waste disposal grounds is also appropriate.

Issue:

Agricultural drainage from land, sloughs and wetlands can be a non-point source of pollution of surface water. Agricultural runoff may contain increased sediment, nutrients and pesticides.

Non-point contamination from agricultural runoff is a particular concern in the Upper Assiniboine River Basin. Sediment levels are generally higher in runoff from agricultural land than from natural areas. Nutrients, in the form of either manure or artificial fertilizers, may bind to sediment or dissolve in runoff water. Pesticides from cropland may also move with runoff water.

The minimization of water-borne contamination from agricultural land would satisfy the interests of both the landowners and environmental concerns. The proper application of fertilizers and pesticides is key to reducing contamination from agricultural runoff. Proper planning of agricultural drainage projects is also necessary to reduce channel erosion and to retain or establish riparian buffers to filter the water entering the drainage system. Planning should also identify land parcels which should not be developed for agricultural use due to their higher value for other purposes.

Water quality initiatives involving agricultural land must rely on public education and demonstration projects.

Conclusion:

Some of the impacts of agricultural land drainage on water quality include nutrient loading, pesticide contamination, heavy metal contamination, erosion and sedimentation. As well, water quality benefits accrued by wetland retention are lost when wetlands are drained.

Issue:
Algal blooms on Lake of the Prairies are a concern.

Algal blooms on lakes are caused by a combination of four factors – nutrients, sunlight, wind and water temperature. Of these contributing factors, nutrient inputs are the only factor over which some control can be exerted.

Although many of the nutrients entering Lake of the Prairies occur naturally, nutrients originating from agricultural runoff are also entering the lake. Sound agricultural practices and riparian zone management upstream of the lake can minimize the loss of nutrients from agricultural land and their introduction to the lake.

Issue:
Increased bank erosion of streams and rivers diminishes water quality. Increased erosion and sedimentation reduce fish spawning areas and habitat.

A considerable amount of natural bank erosion occurs along watercourses in the Basin each year. However, the loss of vegetation cover due to human influences can aggravate streambank erosion. The practice of grazing cattle adjacent to waterways and allowing them free access to the stream destroys riparian cover and compromises bank stability.

Increased suspended solids resulting from erosion impairs the water quality for many consumptive purposes, resulting in more complex treatment processes and higher treatment costs. Fish and other aquatic life are negatively affected by increased sedimentation and loss of shade provided by streambank vegetation. Fish spawning, nursery or feeding areas may be covered with sediments. Similar adverse impacts may affect other forms of aquatic life.

In past years, numerous riparian enhancement demonstration projects have been undertaken in other basins to repair streambanks and replace removed or eroded riparian vegetation. Experience has shown that a re-established riparian area can quickly return the stream to a more natural state.

Additional efforts are needed to move beyond demonstration projects and have landowners assume more direct responsibility for the maintenance of a healthy and effective riparian zone adjacent to streams and marshes. The prevention of bank erosion on private land would improve the sustainability of the owner's operation and reduce harmful environmental impacts.

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Issue:

Livestock operations and range management practices deteriorate water quality and impact downstream users.

As the size and numbers of livestock operations in the Basin increase, concerns are expressed that livestock operations will deteriorate surface water and groundwater quality. There is evidence that overwintering of cattle on watercourses or direct watering within streams, rivers, or lakes can deteriorate water quality by increasing nutrients, soil bank erosion, sedimentation, pathogens, and degrade riparian areas. Further concern has been raised over proper storage and disposal of manure and the prevention of runoff from pens in intensive livestock operations.

Through a variety of programs and incentives provided in recent years, agricultural producers have begun to implement riparian management projects including restricted livestock access to rivers and lakes, off-stream watering facilities and managed grazing projects. These have provided benefits to the producers and the environment.

Much of this work to date has been conducted through public education and demonstration projects. For example, eight livestock producers with operations near the Whitesand River and one of its tributaries are participating in a riparian enhancement program supported by the National Soil and Water Conservation Program. The project has incorporated several activities such as the establishment of vegetative buffer strips, conversion of cropland to forages, off-stream watering, rotational grazing management planning, and relocation of livestock wintering sites away from the river. In Manitoba, Manitoba Agriculture and Food has delivered an educational program that has had success in redeveloping riparian corridors along rivers and streams, and could be of benefit to riparian areas throughout the Basin.

6.2.2 Options

Four options that discuss approaches to protect water quality for water use by improving land and water management practices have been identified:

- promote "best management practices" (BMPs) for crop and pasture lands and livestock production;
- promote agricultural land management practices that will reduce streambank erosion, reduce nutrient loadings in water bodies, reduce pesticides in surface water and protect aquifers from contamination;
- protect aquatic and riparian habitat; and
- reduce pesticides and hydrocarbons from urban runoff.

Option:
Promote "best management practices" for crop and pasture lands and livestock production.

The agricultural industry is becoming increasingly aware of its environmental responsibilities. To further encourage the adoption of the concepts of conservation and agricultural sustainability by the agricultural sector, guidelines (BMPs) should be developed.

BMPs are most effective when initiated by the industry itself, with the assistance of scientists and other professionals. They comprise guidelines to encourage producers to use management practices that protect water quality. BMPs may lead to development of incentive programs to reduce or prevent surface water and groundwater contamination, and provide a tool to assess a producer's activities which may protect against nuisance complaints.

Annual Cropping

BMPs should be developed for annual cropping practices. These should include practices such as residue management, conservation tillage, grassed waterways and buffer strips. Producer cooperation is especially important in controlling the processes that move soil and agricultural inputs into the water. BMPs for annual cropping should also include efficiently managing agricultural inputs, and making use of vegetation to trap and use contaminants that may escape from farmland. The Local Watershed Committees suggested that there should be solid scientific evidence to justify these practices.

Producer cooperation is especially important in controlling the processes that move soil and agricultural inputs into the water.

To clarify confusion over terminology, all agencies should cooperate in a joint effort to develop a 'Glossary of Terms' that are representative and consistent within the agricultural industry for seeding/tillage/rotation systems.

Issue:
Livestock operations and range management practices deteriorate water quality and impact downstream users.

As the size and numbers of livestock operations in the Basin increase, concerns are expressed that livestock operations will deteriorate surface water and groundwater quality. There is evidence that overwintering of cattle on watercourses or direct watering within streams, rivers, or lakes can deteriorate water quality by increasing nutrients, soil bank erosion, sedimentation, pathogens, and degrade riparian areas. Further concern has been raised over proper storage and disposal of manure and the prevention of runoff from pens in intensive livestock operations.

Through a variety of programs and incentives provided in recent years, agricultural producers have begun to implement riparian management projects including restricted livestock access to rivers and lakes, off-stream watering facilities and managed grazing projects. These have provided benefits to the producers and the environment.

Much of this work to date has been conducted through public education and demonstration projects. For example, eight livestock producers with operations near the Whitesand River and one of its tributaries are participating in a riparian enhancement program supported by the National Soil and Water Conservation Program. The project has incorporated several activities such as the establishment of vegetative buffer strips, conversion of cropland to forages, off-stream watering, rotational grazing management planning, and relocation of livestock wintering sites away from the river. In Manitoba, Manitoba Agriculture and Food has delivered an educational program that has had success in redeveloping riparian corridors along rivers and streams, and could be of benefit to riparian areas throughout the Basin.

6.2.2 Options

Four options that discuss approaches to protect water quality for water use by improving land and water management practices have been identified:

- promote "best management practices" (BMPs) for crop and pasture lands and livestock production;
- promote agricultural land management practices that will reduce streambank erosion, reduce nutrient loadings in water bodies, reduce pesticides in surface water and protect aquifers from contamination;
- protect aquatic and riparian habitat; and
- reduce pesticides and hydrocarbons from urban runoff.

Option:
Promote "best management practices" for crop and pasture lands and livestock production.

The agricultural industry is becoming increasingly aware of its environmental responsibilities. To further encourage the adoption of the concepts of conservation and agricultural sustainability by the agricultural sector, guidelines (BMPs) should be developed.

BMPs are most effective when initiated by the industry itself, with the assistance of scientists and other professionals. They comprise guidelines to encourage producers to use management practices that protect water quality. BMPs may lead to development of incentive programs to reduce or prevent surface water and groundwater contamination, and provide a tool to assess a producer's activities which may protect against nuisance complaints.

Annual Cropping

BMPs should be developed for annual cropping practices. These should include practices such as residue management, conservation tillage, grassed waterways and buffer strips. Producer cooperation is especially important in controlling the processes that move soil and agricultural inputs into the water. BMPs for annual cropping should also include efficiently managing agricultural inputs, and making use of vegetation to trap and use contaminants that may escape from farmland. The Local Watershed Committees suggested that there should be solid scientific evidence to justify these practices.

Producer cooperation is especially important in controlling the processes that move soil and agricultural inputs into the water.

To clarify confusion over terminology, all agencies should cooperate in a joint effort to develop a 'Glossary of Terms' that are representative and consistent within the agricultural industry for seeding tillage rotation systems.

Pesticide Handling and Management

BMPs should be developed for the handling and application of agricultural chemicals, container disposal, and equipment cleaning. Soil testing should continue to be encouraged as a means of minimizing fertilizer application rates. Promotion and demonstration of precision farming techniques may work to optimize chemical applications and encourage the use of proper application rates and recommended practices.

The use of approved disposal sites combined with proper on-farm preparation of pesticide containers for disposal should continue to be promoted. There should be extensive testing to determine the effect on groundwater from hazardous substances and storage sites (i.e., collection depots, landfills, discontinued bulk fuel depots, gas stations) in order to measure the full extent of potential contamination. New storage facilities must comply with more stringent regulations that protect the environment from hazardous substances. Education activities should be implemented to caution pesticide users to avoid cleaning sprayers and chemical containers near open water.

Participation of chemical and fertilizer companies in any promotion and demonstration relating to agriculture inputs would be a key component to the success in preventing chemical contamination of surface water and groundwater.

Livestock Industry

BMPs should be expanded for the livestock industry to include modern techniques for managing riparian areas and manure handling and application. Practices designed for improving riparian areas through alternative pasturing, watering systems, and properly located and managed winter feeding sites should be encouraged. The Local Watershed Committees suggested that incentive programs and regulations be developed to reduce stock watering directly from creeks and flowing watercourses. On the other hand, the public should be made aware that proximity of animals, confined or pastured, near surface water does not automatically lead to pollution.

There should be increased awareness of the value of manure as a resource, and the related manure management practices associated with storage, removal and land application. There is local concern over controlling the practice of spreading manure on frozen land and its subsequent movement during runoff.

Conclusion:

Key points that should be targeted for the agricultural industry include the proper handling and application of farm chemicals, appropriate methods and locations for cleaning sprayers and empty containers and use of container disposal sites. Testing for the effects from hazardous substances in landfills, container collection sites, and discontinued bulk fuel depots and gas stations is also important. The industry could also look at the development of Best Management Practices for annual cropping and livestock management.

Recommendation

- **Best Management Practices should be developed for annual cropping practices; for the use, storage and handling of agricultural chemicals; and for the livestock industry that include new techniques to deal with manure management and riparian areas.**

Option:

Promote agricultural land management practices that will reduce stream bank erosion, reduce nutrient loadings in water bodies, reduce pesticides in surface water and protect aquifers from contamination.

Tangible improvements in surface water and groundwater quality in the Basin must be achieved through the commitment of farmers and ranchers in concert with the diversity of other community interests. Manitoba's Conservation Districts serve as a basis of a cooperative coalition of community interests. To achieve an organization with comparable diversity, Saskatchewan may need to amend the scope and role of its Watershed Associations. Local organizations can access assistance from public and private agencies to deliver programs and demonstration projects.

Watershed-based planning should be undertaken to account for the cumulative impacts of drainage on water quality. Watershed planning should include a land use plan to guide water management. The components of the watershed plan would include agriculture and habitat conservation. The Local Watershed Committees agree that a watershed plan with local involvement and government assistance would be best. Maintenance of existing wetlands should be encouraged to ensure some surface water storage within the Basin. This would reduce impacts of drainage on small flood events and would improve water quality by using the wetlands to filter out nutrients and sediments.

Water Quality and Drainage

A code of practice should be developed for the design and construction of drainage projects to reduce related specific impacts on water quality. Drainage project approvals should be coordinated so that more efficient monitoring of water quality is possible. Criteria for rating or evaluating drainage projects as they relate to water quality should be established.

Water Wells

A public education program should be initiated concerning proper well and aquifer management and should include information on proper decommissioning of abandoned wells, maintenance of existing wells and siting, and construction of new wells. Policies should also be developed in this regard. The Manitoba Conservation Districts have access to a cost-shared program for sealing abandoned wells in that province. The Local Watershed Committees agree that such a program should be set up to help landowners in both provinces.

Conclusion:

Proper decommissioning of abandoned wells, proper maintenance of existing wells and proper siting and construction of new wells are all factors to be considered in protecting water quality.

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Conclusion:
Proper decommissioning of abandoned wells, proper maintenance of existing wells and proper siting and construction of new wells are all factors to be considered in protecting water quality.

The outer limits of the aquifers in the region should be better defined with an emphasis on unconfined or vulnerable aquifers. "Pollution Hazardous Zone" maps should be produced to provide a guide in the future development of the area. Local people identified the need to develop a process to protect an interjurisdictional aquifer by cooperatively resolving municipal controls on land development.

Recommendations

- **Watershed-based planning should be undertaken to account for the cumulative impacts of drainage on water quality.**
- **Water quality should be taken into consideration when evaluating drainage projects.**
- **Water wells should be properly sited, constructed, maintained and decommissioned.**

Option: Protect aquatic and riparian habitat.

Preference should be given to licensing of drainage works that protect aquatic and riparian habitat by initiating steps to control channel and bank erosion and contamination of the receiving water body.

Riparian area management policy could be developed in cooperation with landowners. A group should be established to identify riparian assessment needs such as specific riparian areas, protection needed, project development guidelines and legislative changes to affect protection. Local Watershed Committee members suggested that landowners should be involved in planning the rules and regulations for riparian zone protection. Local involvement would provide an opportunity to address concerns with weed control, maintenance and setback distances.

Legislation may need to be developed to protect riparian zones. This would establish setback distances from riparian zones applying to agricultural use. Riparian zone protection would more likely apply to natural watercourses.

Watercourses through agricultural land are either natural (creeks, streams and rivers) or constructed (agricultural and municipal drains). All watercourses should have vegetated buffer strips. Regulations could be developed to protect buffer strips. Local Watershed Committee members felt that there should be incentive programs for landowners to establish buffer strips as well as information on the benefits of buffer strips and clear guidelines for landowners to follow.

Recommendation

- **Maintenance of riparian areas around watercourses and water bodies should be encouraged.**

Option:
Reduce pesticides and hydrocarbons from urban runoff.

Over-application of home and garden chemicals and improper disposal of containers can be a concentrated source of surface water and groundwater contamination. Urban storm runoff water from cities and towns in the Basin should be monitored and evaluated to establish the degree to which storm water quality is a problem. The Local Watershed Committees suggested that the provinces should take a proactive approach in establishing guidelines for urban storm water quality that would allow communities to address problems.

Public information should be provided on proper use of fertilizers and pesticides in the urban environment and the handling, transportation and disposal of containers. Partners and sponsors such as chemical and seed companies could be asked to assist with public awareness, and in supplying information on chemical use, long-term behavior of chemicals, and environmental impacts. Chemical companies, governments, and users should all take action to minimize chemical use, control chemical application and uphold environmental regulations.

The Local Watershed Committees suggested that there would be a better response to proper disposal of chemical containers if a system of container deposits and refunds was introduced. Landfills should be evaluated and monitored as potential sources of groundwater contamination.

The installation and management of gasoline and other underground storage tanks are regulated by Manitoba Conservation and Saskatchewan Environment and Resource Management. Underground storage tanks should be monitored for leaks.

Septic tanks are regulated by Manitoba Health and Saskatchewan Health. Some Local Watershed Committee members suggested that septic tanks at resort areas should be monitored and reported to the public.

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6.3 Municipal Wastewater Treatment

Effective wastewater treatment involves proper planning, design, construction, operation, monitoring, and an investment of hundreds of thousands of dollars by each community. Whether treatment is by lagoons or mechanical wastewater treatment, a coordinated effort of community officials, operators, engineers, and the provincial governments is required. This would lead to efficient treatment system operation and minimum impacts on the health and safety of residents, and the environment.

6.3.1 Issue

Issue:
Municipal lagoon operations, sewage treatment and effluent disposal can impact water quality and must be strictly managed.

While the larger urban centers may operate sewage treatment plants, most small towns and communities in the Basin rely on lagoons as their primary effluent treatment system. Basin residents are concerned about the impacts of sewage effluent discharges into rivers and streams and the impact this may have on water quality for downstream users.

Municipal wastewater treatment systems are composed of a primary cell and one or more secondary storage cells. In the primary cell, heavy organic material settles out, while the lighter organic material remains suspended. In the secondary cell, biological organisms break down the organic material to help purify the effluent. The decomposition processes in the secondary cell are usually a combination of anaerobic and aerobic processes.

Municipal wastewater treatment facilities require a permit or licence to operate. Provincial regulations specify when lagoon systems can be discharged, as well as set objectives for minimum effluent quality to minimize the impacts on receiving water bodies and fish habitat. Typically, lagoons are licensed to discharge once or twice a year, some never discharge, while some larger mechanical treatment plant facilities such as Yorkton continuously discharge.

Lagoons can be potential sources of pollutants including nutrients, heavy metals, pathogens, and a variety of industrial and hydrocarbon chemicals. Groundwater supplies may also be impacted where leachates from lagoons migrate to the water table.

The integrity of lagoons and septic systems needs to be maintained and monitored to prevent seepage to groundwater supplies.

6.3.2 Option

Option:

Reduce biochemical oxygen demands, nutrients and bacteria loading in water bodies.

There are 32 towns in the Basin that operate multi-celled lagoons as part of their wastewater treatment systems. Despite provincial objectives and regulations for the construction and operation of lagoons, lagoon systems have the potential to impact receiving waters. The degree of susceptibility will depend on the location, soil type, and timing of the release.

Alternative management systems for the disposal of treated wastewater effluent should be examined. One such example is the combined use of a traditional lagoon system and constructed wetlands implemented by the Town of Roblin. By using such a system, many towns can begin to use their effluent for economic activity such as irrigation, while reducing the impact on water bodies from lagoon discharges.

Currently, there is no evidence to suggest that wastewater release or seepage is a major concern in the Basin, but it may be a contributing factor. More extensive studies and monitoring are required to determine any long-term effects.

The City of Yorkton uses a mechanical wastewater treatment plant and is the only community in the Basin that has a continuous discharge release. Monitoring has revealed high fecal coliform bacteria counts in Yorkton Creek, particularly during periods of low flow. However, by the time the effluent reached the Whitesand River, there was significant die-off of these bacteria. Overall, the Yorkton sewage treatment plant met the requirements as specified by the Province.

Communities with older lagoons should develop contingency plans for storage of excess effluent and reduce the need for emergency discharges. The current practice is to ensure that the lagoon is properly sized to take this into consideration. Communities should be encouraged through cost-shared programs to improve the efficiency of their wastewater treatment systems. Local Watershed Committee members suggested that regulation and supervision of sewage treatment systems should be increased. Furthermore, a support program should be developed for engineered wetlands to augment sewage treatment.

Recommendation

- **The water quality of effluent and the procedures for its release into the Assiniboine River should be reviewed.**

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6.4 Summary

The long-term potential for the degradation of groundwater quality in the Upper Assiniboine River Basin has increased as a result of human activity. Predictions concerning the expected degree of degradation are difficult given the large number of unknowns. It is certain, however, that the future of our groundwater quality is not only the responsibility of governments and concerned agencies, but also of every person living in the Basin.

Conclusion:
In general the water quality is suitable for its expected uses. There are areas where limitations to such uses as irrigation are evident. It is important to note that in some cases the assessment is based on a limited quantity of data.

The quality of the surface water and groundwater in the Basin is influenced by natural processes as well as by human-related activities. While little can be done to change the natural processes that influence water quality, human-related activities are within the ability of residents to address with some assistance from government. With adequate information, local ingenuity, organized monitoring, data evaluation and government incentives to prevent water quality deterioration, plans can be developed and implemented to protect water quality for everyone in the Basin.

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7.0 Local Watershed Management

Tangible improvements in land and water management in the Basin can only be achieved through the active participation of the rural community. The formation of a watershed management group would be an important step towards resolving the issues identified in the Study. The diversity of interests, responsibilities and expertise needed for this type of undertaking requires the creation of a watershed-scale coalition. Participation would include municipalities, private and public consulting services, local representatives of governmental organizations, interest groups and private organizations, community groups and farmers. Such a coalition could produce considerable dividends in terms of coherence and ownership of solutions to issues by all participants.

The Local Watershed Committees suggested that establishment of associations similar to the Manitoba Conservation Districts be considered on a Basin-wide basis.

7.1 Local Involvement

Local involvement in water management in the Basin is currently provided through the Watershed Associations, Conservation and Development Areas and Manitoba Conservation Districts. In October 2000, the Lake of the Prairies Conservation District was formed in the Manitoba portion of the Basin covering the rural municipalities of Russell, Silver Creek, Shellmouth and Boulton. Prior to this, only a small portion of the Basin in Manitoba was part of a Conservation District, i.e., the area around St. Lazare. These groups have the advantage of solving local problems before any development or changes occur. They work with rural municipalities and provincial authorities and have the advantage of access to cost-sharing programs offered by governments. Manitoba Conservation Districts may form partnerships with non-government organizations to cost-share local projects.

While volunteer work is a major part of the process, it was suggested that these groups must have the right to charge a membership fee or levy additional taxes on the benefactors.

Participants in the Unauthorized Drainage Workshop concluded that citizen associations constituted for water management, such as Manitoba Conservation Districts, could help to curb unauthorized drainage. These associations are successful because the 'ratepayers' become involved with local planning and resolution of the issues. Elected officials know the issues and may become involved in addressing them. Partnerships are formed to get action on addressing the issues. The landowner at the 'bottom' knows what is going on at the 'top'. Provincial and federal agencies could provide technical and/or financial assistance.

As discussed earlier in this report, the Wetlands Committee recommended that watershed plans should be developed as a basis for identifying lands for development and lands for conservation purposes. Also, the Drainage and Flood Control Committee recommended that watershed management plans should:

- promote the retention of existing natural wetlands that provide flood control benefits;
- provide a basis by which to review and approve drainage projects;
- include operating guidelines for controlled drainage works and backflood projects; and
- promote works which incorporate outflow control mechanisms in conjunction with drainage project approvals.

A watershed plan could lead to increased protection of water quality in the Basin. Water supply, groundwater and instream flow management in specific areas could benefit from a watershed plan. The Local Watershed Committees agreed that agriculture support and land use considerations are important to the provincial economy and should be recognized as such in all water management planning.

The goal in having local involvement in watershed management could be to:

- implement a comprehensive approach to support land development that recognizes the importance of wildlife habitat, demonstrates prudent land stewardship and enables local involvement in decision-making.

7.2 Developing a Watershed Management Plan

A detailed watershed management plan should consider the size of the watershed, the structure of the administrative body, the technical and financial support resources, development of a watershed management plan and implementation of the plan. It should reflect the interests of agricultural and other land development, problems identified, and willingness of stakeholders to participate in developing a watershed plan.

The watershed must be large enough to bring together sufficient resources to develop and implement a plan and possibly enable introduction of broad program initiatives. Some members of the Local Watershed Committees suggested that each of their local watersheds might be the target of a watershed plan.

Various administrative models to enable and support watershed planning have been discussed during the Study. Among the existing legislative mechanisms available are the watershed association and conservation area authority in Saskatchewan and the conservation districts program in Manitoba. Both provinces also have legislation that supports municipal land use planning that could be applied to a watershed plan. As well, new mechanisms could be developed to enable development and implementation of a watershed plan.

Regardless of the mechanism used, the key factor in success will be the need for commitment from a broad range of stakeholders to participate in an organized, administrative body to develop and implement a watershed plan. Such an organization could have certain legislated authority to undertake development and conservation initiatives.

Preparation of a plan must involve local landowner interests, municipal councils, local government associations which have projects in the watershed, and government and non-government agencies with water management, agricultural and wildlife resource interests.

Preparation of a watershed plan must involve people who represent local landowner interests, municipal councils, existing local government associations which have projects in the watershed (e.g., conservation area authorities, watershed associations, conservation districts), and government and non-government agencies with water management, agricultural and wildlife resource interests. Commitments would be needed from local and provincial government and non-government interests to dedicate resources to developing and implementing a plan.

Once a plan is developed, opportunities for implementing the plan can be identified. Government and non-government programs are potential sources of funds for undertaking conservation related initiatives. The development and implementation of a plan could follow the process as illustrated on Figure 7.1.

Figure 7.1 Example of Implementation of Watershed Planning

I. Identification of Watershed Planning Area

• geographical extent • background • history of conflict • potential stakeholders

II. Establishment of Watershed Planning Area Advisory Group

• local interests (e.g. RMs) • conservation interest (e.g. SERM) • program resources (e.g. Sask Water)
• compensation (e.g. NAWMP) • expertise (e.g. CWS)

III. Development of Watershed Plan

A.	B.	E.
Identify regions with varying characteristics (UARB study information)	Identify critical wetland and upland habitat (detailed assessments)	Identify program resources • Compensation (e.g. easements, tax adjustments) • Alternative land use (e.g. permanent cover, conservation tillage) • Education (e.g. on-farm planning, tax information, value of habitats, conservation farming) • Mitigation (e.g. protection, or improvement, or restoration of other habitats)
C.	D.	
Determine approaches and procedures for designating land use	Identify lands requiring conservation and subject to agricultural development	

IV. Delivery of Watershed Plan

A. Off-Farm Drainage

1. Sensitive Areas	2. Less-Sensitive Areas	3. Non-approved Drainage Activity
• access to compensation programs • programs for alternate land use • education material for on-farm planning • require mitigation where appropriate *- application denied by Water Advisory Group* *- application accepted by Water Advisory Group with required mitigation specified and monitored* *- permit issued by Sask Water*	• access to compensation programs • programs for alternate land use • education material for on-farm planning • suggest mitigation options *- Water Advisory Group determines if development is acceptable* *- permit issued by Sask Water*	• programs declined by landowners • Water Advisory Group deny application *- Water Advisory Group requests enforcement* *- Sask Water prosecutes*

B. On-Farm Drainage or Clearing

• access to compensation programs • programs for alternate land use
• educational material for on-farm planning • suggest mitigation options

- *Water Advisory Group ensures landowners are aware of available programs and information*

C. Other Items

• land use • riparian area management

8.0 Recommendations

Based on technical studies and discussions with the Local Watershed Committees, following are recommendations to guide future water management in the Basin.

8.1 Watershed Management

1. Watershed plans should be developed with local involvement as a basis for land and water management, development and conservation. One or more pilot projects to undertake watershed planning should be initiated as soon as possible.

2. Proposed drainage projects should be planned and approved within the context of a local watershed plan which considers the impacts at downstream locations. The plan should include operating guidelines for controlled drainage works and backflood projects so that downstream damages are minimized.

3. Measures should be taken to ensure the availability of adequate supplies of good quality water in all areas of the Basin. In particular, the expected expansion in livestock production will require a dependable supply of good quality water.

4. Instream flow needs for maintenance of aquatic habitat and fisheries should be an integral part of future water management, particularly when changing the operating guidelines for a dam and when granting new water allocations.

5. Water quality should be taken into consideration when evaluating drainage projects. Criteria should be established for rating or evaluating drainage projects. A code of practice should be developed for construction of drainage projects to reduce impacts on water quality. The cumulative impacts of drainage on water quality should be considered in the context of a watershed plan.

8.2 Best Management Practices

6. Where drainage projects are approved, the construction of works such as backflood projects or controlled drainage should be promoted to minimize adverse downstream effects.

7. Best Management Practices for agriculture and other industries should be developed and promoted with emphasis on surface water and groundwater protection.

8. Agricultural practices such as conservation tillage and permanent cover programs which retain or re-establish perennial cover should be promoted as means to reduce runoff rates and volumes.

9. The livestock industry should be encouraged to improve riparian areas through alternative pasturing, livestock watering systems, and properly located and managed winter feeding sites.

10. Maintenance of natural vegetation cover around water bodies should be encouraged. Licensing preference should be given to drainage works that include establishment of vegetation cover such as grasses to protect drainage channels from erosion. Buffer strips or bush adjacent to watercourses or water bodies should be protected to reduce the potential for erosion or contamination of the receiving water body.

11. Wells should be properly sited, constructed, maintained and decommissioned to protect groundwater from contamination.

8.3 Policy, Legislation and Enforcement

12. A planning and approval process should be developed to support landowners and government resource management agencies in determining appropriate levels of development.

13. An effective regulatory framework for drainage should be established which takes into account the resources and expertise required for proper review and enforcement.

14. Provincial and local governments should ensure that additional development does not occur within flood prone areas through a review of the processes for subdivision approvals and granting of building permits.

15. Economic and other factors faced by producers in their decision whether or not to drain wetlands should be considered in the development of environmental, social, or economic programs or policies to address drainage issues.

16. Regulations should be reviewed that apply to the construction and monitoring of facilities such as landfills, lagoons, chemical storage and pesticide container disposal sites. (Saskatchewan)

17. Agencies responsible for surface water and groundwater management and protection should be encouraged to develop a joint database of the current status of water quality.

8.4 Education and Demonstration

18. Water management agencies should expand efforts to promote awareness of the hydrologic processes that lead to floods, especially large floods, as well as the effect of water control projects on flow rates and water levels.

19. Information should be provided on the value and proper application of manure as a nutrient-rich fertilizer.

20. Education activities should be implemented to caution pesticide users to avoid cleaning sprayers and chemical containers near open water, to apply product at the proper rates and follow label restrictions and recommended practices.

21. A public education program on proper well and aquifer management should be initiated to protect groundwater formations from contamination.

22. Agencies should provide coordinated and effective communication to the public and stakeholders on land management issues that affect surface water and groundwater.

23. Information and extension programs should be developed to increase awareness of the importance of wildlife habitat (wetlands, uplands, and riparian areas) in the Basin as well as the opportunities to implement land use activities that will benefit both agriculture and wildlife.

8.5 Research and Studies

24. Water and wetland management agencies should:

- develop criteria to assist landowners in planning, and resource managers to identify, wetland and upland habitat that requires protection;
- collect further data for very small, shallow wetlands to provide greater confidence in applying the area/volume relationship in the range of wetlands subject to contour ditching and V-ditching;
- develop instream flow guidelines;
- investigate structural and non-structural means to improve operational flexibility of the reservoirs;
- undertake aquifer characterization including aquifer production capabilities and water quality analysis to define the groundwater supply and facilitate economic development;
- develop aquifer maps to define various aquifers in the region with an emphasis on unconfined or vulnerable aquifers;

- determine any long-term effects of lagoons on receiving water bodies through more extensive studies and monitoring; and
- review the required quality of wastewater effluent and the procedures for its release to receiving waters.

25. Research agencies should:
- develop remote sensing technology for application to the detection of wetland drainage;
- continue investigations into the relationship between snowmelt runoff and agricultural practices such as stubble management, conversion to permanent cover and clearing of bush;
- continue research and development of practical watershed modeling tools which can be used by provincial regulatory agencies to assess the impact of drainage projects on watershed hydrology; and
- develop watershed models with improved simulation of hydrologic processes on the Canadian Prairies such as variable contributing area and wetland storage.

8.6 Monitoring/Assessment

26. An enhanced water monitoring program should be implemented in the Basin to obtain data on actual surface water and groundwater usage and to ensure that all major usage is licensed and appropriately monitored. Efforts should also be made to improve the timely analysis of data where warranted.

27. Provincial agencies should continue to monitor developments in remote sensing technology with a view to future application in the detection of wetland drainage.

28. Water and wetland management agencies should define common standards and definitions in the assembly of wetland databases.

29. An inter-agency working group should be formed to continue assessing the hydrologic effects of wetland drainage and land cover change in the Basin using the knowledge base developed in this Study.

30. Studies should be conducted to determine if engineering works are a practical method of reducing the risk of flood damages to existing developments in flood prone areas.

31. Testing of private groundwater wells should be encouraged.

32. Groundwater monitoring should be done in the vicinity of potential sources of contamination (e.g., manure storage sites, chemical collection depots, landfills, discontinued bulk fuel depots, and gas stations) to determine whether contamination is occurring.

33. Long-term monitoring of surface water quality and riparian health on a watershed basis should be implemented. Monitoring should be carried out to collect information to confirm the current status of water quality and identify potential problems in the Basin.

8.7 Incentive Programs

34. Programs should be developed to encourage the retention of remaining natural wetlands to conserve habitat.

35. Programs should be developed to encourage retention of those wetlands that provide significant benefits in controlling snowmelt runoff into the stream network in most years.

36. Partnerships for the conservation of wetland and upland habitat should be pursued with non-government agencies and other interested parties.

37. Beaver management programs should be developed. Specific problem areas in the Basin should be identified. Local governments and resource management agencies should work together to target management efforts.

38. Programs should be developed to encourage the adoption of compatible land use practices in flood prone areas in order to reduce damages to agricultural lands and urban developments located adjacent to streams and water bodies.

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Water Management Legislative Framework

The following policies, legislation, guidelines and programs are relevant to how water is currently managed in the Basin.

Federal - Provincial Jurisdiction

Generally the provinces have jurisdiction over their waters, but federal legislation governs some aspects of water development and its use. The *Constitution Act*, 1867, coupled with the Natural Resource Transfer Agreement (*Constitution Act*, 1930, Schedule 2) assign the majority of powers in water management to the provinces including ownership of most of their water resources, which includes both surface and groundwater. This provided the provinces with the authority to legislate on all aspects of water supply, use, pollution control, hydroelectric and non-nuclear power development, irrigation and recreation.

The federal government maintained responsibility for water on federal lands, First Nations lands and water located on or across international boundaries. The federal government legislates on fisheries, protection of navigable waters, shipping, some specific aspects of environmental protection, and international water management. The Canada Water Act of 1970 established the Department of Environment in 1971 and entrusted it with providing leadership on freshwater management.

Shared federal-provincial responsibilities include: interprovincial water issues, agriculture, significant national water issues and health.

Federal Legislation

Navigable Waters Protection Act

The Ministry of Transport, Canadian Coast Guard is responsible for administering this Act which ensures that navigable waters remain open to navigation. The Act requires that any works which are built or placed in, on, over, under, through or across any navigable water, that substantially interferes with navigation, be approved by the Minister; and any vessel that obstructs or endangers a navigable water be reported to the Minister or to the chief officer of customs and excise. The Act prohibits the deposition of wood products, earth materials or rubbish into the waters; and establishes regulations to govern ferry cable and swing or draw bridges.

Prairie Farm Rehabilitation Act (PFRA)

This Act is administered by Agriculture and Agri-Food Canada and provides for rehabilitation of drought and soil drifting in the prairies. Through establishment of PFRA committees, the Minister is advised as to the best methods to develop and promote systems of water supply that will afford the greatest economic security.

The Act also empowers the Minister to undertake the development, operation, and maintenance of any project and enter into agreements with any province, municipality, or person.

Fisheries Act

Department of Fisheries and Oceans is responsible for administration of the *Fisheries Act* which prevents obstruction across streams and provides for the regulation of fishing, management of fish stocks, fish habitat protection and pollution prevention measures. Ministerial approval is required for any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat.

Canada Wildlife Act

This Act, administered by the Environment Canada, applies to a species that is wild by nature and the habitat of any such animal, plant, or other organism. Habitat includes any water on or flowing through land belonging to Canada. The Minister may designate an area as a wildlife area. Within a wildlife area no person shall damage or destroy or remove a plant or destroy or molest animals, nests, or eggs thereof, without a permit issued by the Minister.

Canadian Environmental Assessment Act

Environment Canada administers the Act. The purpose of the *Canadian Environmental Assessment Act* is to ensure environmental effects of a project are considered, promote sustainable development, eliminate duplication of project assessment, and provide an opportunity for public participation. Any project where a federal authority is the proponent, making or authorizing financial assistance, or selling, leasing or disposing of federal lands to a province for a project is required to undergo an environmental assessment. Projects may be either a physical work or physical activity. Regulations stipulate what projects require the proponent to apply for a permit or licence under the Act. The Act also establishes the Canadian Environmental Assessment Agency which advises the Minister of Environment and administers the environmental assessment process.

Canada Water Act

Environment Canada administers the Act. *The Canada Water Act* provides the basis for federal-provincial cooperation in water resource management, water quality management and conservation. It includes the authority to conduct research, make inventories, develop comprehensive management plans and establish special water quality management areas to address concerns with waste. Formulation of policies and programs are carried out through intergovernmental committees.

Indian Act

The Act is administered by the Minister of Indian and Northern Affairs. This Act addresses matters relating to Indian Affairs and reserve land. Any non band member who wishes to occupy or use a reserve to otherwise exercise rights on a reserve requires a permit from the Minister. Regulations may be made by the Governor in Council and by-laws may be made by the Council of a band regarding the preservation, protection and management of fur-bearing animals, fish and other game on the reserve.

Federal Provincial Agreements

The Master Agreement on Apportionment

On interprovincial waters, The Master Agreement on Apportionment forms the basis for determining the apportionment for the eastward flowing interprovincial waters in Alberta, Saskatchewan and Manitoba. The agreement is administered through the Prairie Provinces Water Board (PPWB). The board is an independent agency that receives administrative support from Environment Canada and whose responsibilities are exercised through the staff and resources of member governments. The board is responsible for:

- administering the Master Agreement as well as several schedules;
- review of water quality problems, particularly those located at interprovincial boundaries and the development of recommendations for their resolution; and
- monitoring flows and water quality at the inter-provincial boundaries to establish an administrative structure to undertake its responsibilities.

In addition to the apportionment monitoring function, the PPWB considers other water resource management issues as requested. The PPWB objectives state that the board will promote the integrated development and use of water and water-related resources to support economic growth and to participate in the formulation and implementation of comprehensive planning or development programs according to their national, regional, and provincial interest and importance. The Board will provide coordination and liaison between water resource agencies and will advise governments on the planning, development, and management of interprovincial waters.

Three standing committees have been established to assist the Board in specific undertakings. They are the Committee on Hydrology, the Committee on Water Quality, and the Committee on Groundwater.

Provincial Legislation - Manitoba

Manitoba Conservation

The Water Resources Administration Act

The Water Resources Administration Act establishes the Lieutenant Governor in Council's authority to designate any water control work, natural water channel or lake as a provincial waterway. The Minister is authorized to manage and administer all those matters that relate to the construction or operation of water control works and matters dealt with under *The Dyking Authority Act, The Ground Water and Water Well Act, The Water Power Act,* and *The Water Rights Act.*

This Act also sets out prohibitions of use within designated flood areas. Within designated flood areas, it makes the requirement for a permit to be issued that authorizes the occupation and construction of buildings, and states that the permit can contain terms and conditions that are consistent with existing and the new proposed "Designated Flood Area Regulation".

The Water Rights Act

All property in and all rights to the use or diversion of all surface and groundwater is vested in the Crown in the right of Manitoba. The use or diversion of water; or construction, establishment or maintenance of works requires a licence issued under *The Water Rights Act.* Water is allocated on a "first in time, first in right" principle. Priorities of purpose have been established to address situations with identical submission dates. The highest priority is domestic use followed by municipal, agricultural, industrial, irrigation and other purposes, respectively. Diversions include drainage of agricultural land and flood control works. The Act also provides for a reservation to be placed on unlicensed water and for agreements or arrangements to be entered into regarding interprovincial boundary waters.

The Ground Water and Water Well Act

Licensing of all persons engaged in the business of drilling water wells is provided for under *The Ground Water and Water Well Act.* The Act provides the legal right to limit flow from wells to protect the aquifer. Specifications, standards and safety procedures for wells and well drilling are prescribed in the regulations.

The Water Commission Act

The Water Commission Act establishes a five member commission to study projects, problems and schemes referred by the Minister. The Commission prepares a report and makes recommendations designed to secure the maximum benefits from the use, allocation and conservation of water. In 1997, for example, the Manitoba Water Commission conducted an independent review of actions taken during the 1997 Red River flood for the Minister of Natural Resources.

The Water Supply Commission Act

Establishment of a water commission area and a water commission for each district, is provided for in *The Water Supply Commission Act*. Currently there is the Souris River Water Commission and the Lower Red River Valley Water Commission. Both act in an advisory capacity only.

The Endangered Species Act

The Endangered Species Act ensures the protection and enhances the survival of endangered and threatened species and their habitat. The Act prevents the destruction, disturbance or interference of their habitat and the damage, disturbance, obstruction or removal of a natural resource on which an endangered or threatened species depends on for its life and propagation.

The Wildlife Act

The Wildlife Act authorizes the Province of Manitoba to designate special areas for the better management, conservation and enhancement of the wildlife resource; simulate what constitutes an offence; and determine licensing, permit and enforcement provisions. Authorization is required, in the form of a licence or permit, to destroy or damage habitat on Crown lands or to wilfully destroy the nest or eggs of any game bird or bird listed in the schedule.

The Manitoba Habitat Heritage Act

Establishment of The Manitoba Habitat Heritage Corporation is provided for in *The Manitoba Habitat Heritage Act*. The Corporation is responsible for conservation, restoration and enhancement of fish and wildlife habitat and populations on Crown land and private land by agreement with the owner.

The Crown Lands Act

Crown lands are managed and administered under *The Crown Lands Act*. The Act provides for the sale, lease, permitting, licensing, enforcement and reservations for specific departmental and government programs. Out of every disposition of Crown land there is reserved to the Crown, in the case the land extends to the shores of any navigable water or an inlet thereof or to the boundary line between Canada and the United States, a strip of land one and one-half chains in width measured from ordinary high water mark or from the boundary line. Agricultural disposition of Crown lands is administered by Manitoba Agriculture and Food.

The Provincial Parks Act

The Provincial Parks Act provides the authority to establish lands as provincial parks. In accordance with parks classifications and land use categories, the purpose may be to conserve ecosystems and maintain biodiversity. Regulations have been developed respecting the protection and use of water, interference with drainage patterns and pollution of water.

The Sustainable Development Act

Sustainable development will be implemented in the provincial public sector and promoted in the private industry and in society through the framework created in *The Sustainable Development Act*. The government will address sustainable development through development of new legislation, revision of existing legislation and development of reporting requirements for departments, Crown agencies and provincial public sector organizations. The framework created in the Act provides for a; Manitoba Round Table for Sustainable Development, Sustainable Development Coordination Unit, Sustainable Development Strategy, Code of Practice and Sustainable Development Innovation Fund.

The Sustainable Development Amendment and Consequential Amendments Act

This Act transfers some of the responsibilities of the Manitoba Environment Council (established under *The Environment Act*) to the Manitoba Round Table for Sustainable Development (established under *The Sustainable Development Act*). It also transfers the responsibilities of the former Sustainable Development Coordination Unit to the Department of Conservation (formerly Natural Resources).

The Environment Act

The intent of *The Environment Act* is to provide for: environmental assessment of projects which are likely to have significant effects on the environment; development and implementation of standards and objectives for environmental quality; and development of environmental management strategies and policies for the protection, maintenance, enhancement and restoration of environmental quality. There are three classes of environmental assessments, dependent on the size of the project, each with its own set of licensing criteria.

The Dangerous Goods Handling and Transportation Act

The Dangerous Goods Handling and Transportation Act establishes controls over all aspects of dangerous goods affecting the environment and/or public health with an emphasis on standards for handling, disposal of hazardous wastes, environmental accident response and highway transportation.

Manitoba Intergovernmental Affairs

The Manitoba Water Services Board Act

The Manitoba Water Services Board Act provides for the establishment of The Manitoba Water Services Board. The Board's objective is to provide for the development of water and sewage treatment facilities and the related infrastructure. The Board owns and operates water supply systems.

The Conservation Districts Act

The purpose of *The Conservation Districts Act* is to provide for the conservation, control and prudent use of resources through the establishment of conservation districts and to protect the correlative rights of owners. A municipality or group of municipalities partner with the province to form a conservation district. Each management plan developed by the Conservation District Board must comply with *The Water Rights Act, The Land Rehabilitation Act* and *The Planning Act*. Conservation districts deliver sustainable soil and water management programs.

The Municipal Act

The Municipal Act provides for the formation of a municipality, its council and the jurisdiction under which it governs. With respect to water, a municipality may pass by-laws regarding drains and drainage on private or public property.

The Planning Act

The Planning Act provides for the development of Provincial Land Use Policies, establishment of special planning areas and planning districts and provides for the development of basic planning statements, development plans and zoning by-laws. Special planning areas are designated for the protection and conservation of natural resources such as lakes, rivers and shore lands.

Manitoba Agriculture and Food

The Department of Agriculture Act

The Department of Agriculture Act allows the Department of Agriculture and Food to institute and carry out programs, projects and undertakings related to any aspect of agriculture or of rural communities. The Departments of Agriculture and Food and Conservation cooperate in matters of land drainage, irrigation and rural water supplies.

Manitoba Highways and Government Services

The Highways and Transportation Department Act

The Highways and Transportation Department Act allows the Department of Highways and Government Services, with consent of the Minister of Agriculture and Food, to construct, maintain and acquire land for the purpose of draining water from departmental roads.

Manitoba Health

The Public Health Act

The development of regulations and orders respecting: sewage treatment systems; construction, maintenance and purification of water systems and supplies; and preventing pollution of wells, underground waters; and springs, is provided for in *The Public Health Act.*

Manitoba Culture and Tourism

The Heritage Resources Act

Under *The Heritage Resources Act* sites considered of heritage significance may be designated either as a provincial or municipal heritage site and provided protection through the issuance of a heritage permit or a municipal heritage permit respectively. Within a heritage site, before commencing works, activity, development or project, an application must be submitted for a heritage permit. The proponent may be required to submit a heritage resource impact assessment and/or development plan.

Provincial Legislation - Saskatchewan

Provincial Policy

Provincial Wetlands Policy

The policy, approved by cabinet in March 1995, promotes wetland benefits and helps ensure a consistent provincial approach to land use policies and programs that impact wetlands. The policy is a statement of principles requiring voluntary interest and compliance, it is not a regulatory document or law. The policy is Saskatchewan's commitment to wetland conservation and the first component of a provincial water strategy. Provincial departments, crowns, and agencies that participated in policy development and which deliver land/water use programs and policies are required to guide policy implementation.

Sask Water

The Water Corporation Act

Sask Water was established July 1, 1984 by the proclamation of *The Water Corporation Act.* The Act empowers and mandates the corporation to undertake numerous responsibilities to manage, protect, and develop the provincial water resource. Sask Water is responsible for most provincial water management related activities except the regulation and operational responsibilities for municipal and rural domestic water quality objectives. With the coming into force of *The Water Corporation Act,* the prior *Water Rights Act* and the *Drainage Control Act* were repealed. However, the regulations for the administration of each respective Act were retained and attached to *The Water Corporation Act.* The Water Rights regulations primarily set out how a person or corporation goes about getting a licence to divert water. The Drainage Control regulations establish the procedure for obtaining a licence for drainage works. Exclusion from the requirement for permit includes cases involving works existing prior to 1981, works authorized by the Minister, or works approved under "other" legislation.

The Watershed Associations Act

This Act allows for the establishment of Watershed Associations by order-in-council following receipt of resolutions passed by local agencies, on a voluntary basis, such as rural and urban municipalities, conservation and development area authorities, regional parks, resort villages etc. The governing Board is appointed from representatives from each agency. The Board has powers to assess levies to each agency to cover administrative costs, and costs of construction, operation, and maintenance of works. Boards have expropriation powers and may undertake construction, replacement, or maintenance of a public work if the utility is not exercising its powers. The public utility can be assessed and shall pay costs of such

activities. Boards can plan, undertake, construct, alter, improve, maintain, repair and operate projects for the purpose of storing, conserving, protecting, or developing the water resources available. In addition, it may conserve, control, protect, and develop land, forests, recreational resources, and fish/wildlife habitat.

The Conservation and Development Act

The Act provides for the establishment of conservation and development areas by ministerial order upon receipt of a petition signed by at least two-thirds of the landowners within a proposed area, or by discretion of the Minister. A board is elected for a three year term and triennially thereafter. An area authority board has powers to assess benefitted lands to pay local costs of administration, construction, operation and maintenance of works. Other powers include expropriation of lands, borrowing of money, and issuing debentures. An area authority board can promote, construct, operate and maintain flood control, drainage, and multi-purpose works for the benefit of agriculture lands and wildlife.

The Irrigation Act

The Irrigation Act (1996) consolidated former legislation and provides uniform legislation for all irrigators in the province. The new Act replaces the repealed *Water User's Act, Irrigation Districts Act,* and *South Saskatchewan River Irrigation Act*. The new Act deregulates the process between the irrigator and the district board, simplifies and provides for administration of irrigation by clarifying the respective roles of irrigation district boards, the minister responsible, and Sask Water who administers the Act. The Act also provides for establishment of the Irrigation Crop Diversification Corporation, and provides for establishment and administration of the Saskatchewan Irrigation Projects Association. It further establishes the requirement of an irrigation certificate (soil-water compatibility), establishes district irrigation replacement funds and establishes the form of water service agreements prior to a person receiving irrigation services.

The Groundwater Conservation Act

The purpose of *The Groundwater Conservation Act* is to obtain logs of wells drilled and information on formations and materials encountered during drilling operations. This is to assist in groundwater and geological studies and to provide for the conservation, development, and utilization of groundwater resources and prevent pollution and contamination of groundwater. Regulations which provide specific requirements for groundwater projects accompany this Act. Approval for groundwater use is issued under *The Water Corporation Act.*

Saskatchewan Environment and Resource Management (SERM)

Ecological Reserves Act

The intent of this legislation is to preserve designated Crown Lands in order to sustain a unique or representative part of the natural environment, water inclusive. The regulations enable Crown Land to be designated as an Ecological Reserve and outlines those activities which may take place within the Reserve. This Act takes precedence when in conflict with other Acts.

The Parks Act

The Parks Act provides the authority for the establishment, maintenance, and use of parks and parklands within the province. This includes protected areas, recreation sites, and/or historic sites. Once established, park land cannot be granted or transferred, but the Minister may make dispositions subject to reservations.

The Critical Wildlife Habitat Protection Act

This legislation provides for the protection and management of Crown Lands critical to the maintenance of wildlife populations. Critical wildlife habitat lands are administered in accordance with the *Provincial Lands Act*. No grant or transfer of critical habitat lands is possible unless a disposition is authorized by the Minister or by regulation subject to specific conditions.

The Wildlife Act, 1997

The main purpose of this Act is for protection of wildlife and species at risk. It states that the property in all wildlife within Saskatchewan is vested in the Crown. The Minister has appointed wildlife officers who have the power of peace officers to enforce the Act and regulations and are entitled protection pursuant to the Criminal Code. The Minister administers the Big Game Damage Compensation Fund which provides compensation to producers for damage or loss by big game. The Minister may enter into agreements with persons, Indian Bands, or government for:

- protecting, managing, conserving, reintroducing or encouraging the propagation of wildlife and wild species and protecting, managing and conserving their habitats;
- establishing and promoting programs respecting public safety, education about wildlife or wild species or other conservation oriented programs; and
- respecting any matter considered to be necessary by the Minister to carry out the provisions of this Act.

Regulations can constitute any area of provincial land as a registered trap line district, a fur conservation area, or a fur conservation block. Regulations designate and list the wild species at risk and exercise prohibitions. There are offence and penalty provisions in the Act.

The Environmental Management and Protection Act (EMPA)

The EMPA governs pollution control in the province. The Act specifically deals with water pollution control, industrial effluent works, sewage works, waterworks, and regulation of all matters concerning water quality. A ministerial order can have the individual responsible for a pollutant discharge take necessary measures to protect or restore the environment. Individuals, including the Crown, may seek compensation for damages incurred from a pollutant discharge, or for failure in the execution of a duty. The Act establishes permit requirements, and procedures of permit acquisition for discharge of contaminants which might cause a change in water quality or water pollution. The Act sets out fines for general offences, and most significantly on summary conviction for hazardous material offences and mining industry polluters. Since 1994, SERM has regulated work around water bodies including activities affecting the bed or bank of a watercourse, and includes removal of material or dumping of material into a water body. Failure of a developer to obtain a permit (shore land alteration permit) constitutes an offence. Removal of brush and beaver dams are excluded. Regulations include Water Pollution Control regulations, Water Works regulations and Environmental Spill regulations.

The Environmental Assessment Act

This legislation authorizes SERM to review potential environmental effects of a proposed development. The Act lays out the process used to determine whether or not a project is a development and provides opportunities for public to influence government decisions about a project. Any project defined as a development must be approved by the Minister of SERM before it may proceed. A proponent is required to complete an environmental impact assessment (EIA) for any project proposal that is defined as a development. Subsequent to review of the EIA by a technical panel, the Minister may approve the project with or without conditions, or may not allow the development to proceed.

Conservation Easements Act

This legislation is a tool which can be used by government and other conservation groups to add to the Representative Areas Network, protect game habitat, and facilitate other conservation work in partnership with landowners. Conservation organizations by purchasing such easements can cover the cost of protecting conservation values while the land remains private and can be used for compatible uses such as agriculture. Amendments to the *Federal Income Tax Act* enable landowners donating easements on ecologically sensitive lands to subtract the value of the easement from taxable income in the year of donation or spread over 5 years. Conservation easements are registered against lands to ensure environmental protection. The Act is accompanied by administrative regulations.

The Water Appeal Board Act

This legislation supports the *Water Corporation Act* by providing an administrative mechanism for appeal of all decisions of Sask Water relating to its water management mandate. Appeals are heard by a board appointed by the Minister of SERM. The Act empowers the board to make it's own rules of practice and procedures subject to approval of the Lt. Governor in council. The board has no power to determine liability or award damages. The board may affirm, vary, or substitute its own decision on appealed decisions of Sask Water. Board decisions are filed with the court and thereafter are enforceable as a judgment of the court. Sask Water or any person aggrieved by a decision of the board may appeal to a judge of the court on a question of law.

Saskatchewan Wetlands Conservation Corporation

The Sask Wetlands Conservation Corporation (SWCC) is a crown corporation established in 1990. Its purpose is to co-ordinate implementation of the North American Waterfowl Management Plan (NAWMP) in Saskatchewan by encouraging sound land use practices for the benefit of people and wildlife. SWCC is responsible for conservation, restoration and enhancement of fish and wildlife habitat and populations on Crown land and private land by agreement with the owner. The SWCC programs provide technical advice on wetland, range, and riparian management.

Saskatchewan Agriculture and Food

The Provincial Lands Act

Crown Lands are managed and administered under this legislation. The Act outlines the duties of the Minister. The Minister may transfer provincial lands to any other department for any purpose. Out of every disposition of Crown land, the Crown reserves the property in and right to use of all water powers, and an exclusive or perpetual interest in lands forming the beds and shores of water bodies. Disposition of water is made pursuant to *The Water Corporation Act*. Provincial lands may be set aside for use such as provincial parks, forest reserves, game preserves, bird sanctuaries, public resorts, sites for harbours, piers, bridges, treaty land entitlement, or transfer to the government of Canada lands required for any project under the authority of PFRA.

The Agriculture Operations Act

By repeal of *The Pollution (by livestock) Control Act, The Agriculture Operations Act* came into force in 1996. The Act provides for protection from nuisance claims if an agricultural operation is functioning consistent with normally accepted practices. An agricultural operations review board hears complaints from persons aggrieved by an agricultural operation. Subsequent to board proceedings, the board may dismiss a complaint, recommend a cease to the practice, or to modify a practice that is the subject of a complaint. The Act further sets out the terms and requirements for an approved plan for waste storage and management associated with and Intensive Livestock Operation (ILO). The minister can order corrective action if an ILO is, or is threatening to pollute, and may impose a fine of not more than $50,000 on summary conviction and/or $1000/day in the case of a continuing offence.

The Crop Insurance Act

The Saskatchewan Crop Insurance Corporation administers *The Crop Insurance Act*. The Corporation is an agent of the Crown and is administered by an appointed board. The Corporation administers a Crop Insurance Program that provides insurance to compensate for crop losses. The Corporation administers the Canada-Saskatchewan waterfowl Crop Damage Compensation program to cover non-insurable grain crop losses arising from migratory waterfowl damage.

Saskatchewan Municipal Government

The Urban Municipalities Act

A city council may make by-laws for the health and prevention of the spread of communicable disease, including prohibition or regulation of bathing/washing in public waters. Council can create by-laws that provide for the collection, removal, or disposal of solid wastes. Council can make by-laws controlling the use of water supply, providing water, regulating use and preventing contamination of any stream or water flowing through or past an urban municipality. Council can establish works for supply, collection, treatment, storage, and distribution of water, and collection, transmission, storage, treatment and disposal of sewage or storm drainage. There are penalties for violation of any by-laws passed.

The Rural Municipalities Act

Rural municipal councils may make grants to the installer of sewer or water systems for residents of hamlets, provide for and regulate supply of waters to the municipalities, and enter into contracts with Sask Power for power generating or distribution. Council can construct any drains it may consider necessary and can remove obstructions in drains. A council may regulate waste disposal sites, and provide for the cleaning up of the foreshore of any lake within the municipality and

constructing pathways, even if the municipality does not own the foreshore (subject to the rights of the owner). Council may declare a drain, ditch, watercourse, pond, surface water or any other matter / thing in or on private land a nuisance and dangerous to the public safety or health. Council can order that the nuisance be removed or otherwise dealt with, and upon non compliance by the owner or occupant undertake the work and recover costs as an added tax to the land.

The Rural Municipal Act allows a council to establish and operate public utilities(e.g., rural water pipelines). A council may delegate powers to a utility board. As a legal entity, a utility board can pass by-laws, enter into agreements and borrow money. A council may pass by-laws imposing daily or maximum fines for breach of any of the municipal by-laws.

The Planning and Development Act

The Planning and Development Act provides a municipality with the legal framework necessary to do community planning. The keystone of the planning process is a general policy plan. The Act allows two types, a Basic Planning Statement and a Development Plan. A zoning by-law must be adopted in conjunction with a policy plan and serves to implement the plan. The Act allows two or more municipalities to form a Planning District to deal with problems and opportunities that extend across municipal boundaries.

Municipalities can exercise some control over local water resources management. They can create policy plans and by-laws that conserve and improve the physical environment, provide municipal service and facilities including water and sewage systems, as well as manage and preserve water storage areas.

Department of Health

The Public Health Act

Medical health officers inspect water works and sewage works to determine the quality of water from water supply and waste treatment works. Should the water quality of the works be considered to pose a danger to the public health, the minister can order steps be taken to alleviate the danger. There are regulations relating to the construction and maintenance of water supply systems concerning the efficiency and purity of supply. There are also regulations regarding the construction, maintenance, cleaning, and disinfecting of drains, sewers, and sewage disposal systems.

Upper Assiniboine River Basin Study Committee Members

Management Committee

Betty Collins, Co-chair	Moose Jaw	Sask Water
Larry Whitney, Co-chair	Winnipeg	Manitoba Conservation
Dick Menon	Brandon	Manitoba Intergovernmental Affairs
Dwight Williamson	Winnipeg	Manitoba Conservation
Merv Swanson	Saskatoon	Saskatchewan Environment and Resource Management
Sheldon Clarke	Regina	Saskatchewan Municipal Affairs, Culture and Housing
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Gerry Wetterstrand	Regina	Agriculture Canada - PFRA

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Bart Oegema	Moose Jaw	Sask Water
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Water Quality Committee

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Gary Coghill	Regina	Saskatchewan Agriculture and Food
Jeff Olson	Melville	Saskatchewan Environment and Resource Management
Dave Barisow	Moose Jaw	Sask Water

Upper Assiniboine Local Watershed Committee

Sam Bowey	Preeceville	Saskatchewan Wildlife Federation
Michael Bryant	Kamsack	Cote First Nation
Wilfred Ebel	Preeceville	RM of Preeceville #334, Division 4
Randy Friday	Kamsack	Cote First Nation
Wayne Mastrachuk	Preeceville	Individual
Geraldine Mecas	Kamsack	Keeseekoose First Nation
Ken Mitchell	Preeceville	RM of Preeceville #334, Division 2
Will Moysiuk	Sturgis	Individual
Owen Myhr	Preeceville	Saskatchewan Wildlife Federation
Dale Nelson	Kamsack	Town of Kamsack
Don Olson	Sturgis	Town of Sturgis
David Sawkiw	Preeceville	Individual
Bruce Steppan	Endeavour	RM of Hazel Dell #335

Lower Assiniboine Local Watershed Committee

George Boucher	Binscarth	RM of Ellice
Morley Clarke	Spy Hill	Marchwell South Conservation & Development Area #172
Leo Fuhr	Langenburg	RM of Churchbridge #211
Jake Haas	Langenburg	Concerned Ratepayers of Churchbridge RM
Rick Keay	Inglis	Shellmouth-Assiniboine Valley Economic Development Group
Derek Clarke	Miniota	Upper Assiniboine River Conservation District
James Lungal	Russell	Individual
Darwyn MacKenzie	Langenburg	Individual
Kim Marschall	Shellmouth	Individual
Neil Mehrer	Churchbridge	Individual
Gene Nerbas	Shellmouth	RM of Shellmouth
Kelvin Nerbas	Shellmouth	Shellmouth Valley Landowners
William Nevistiuk	Inglis	RM of Boulton
Rod Roden	Langenburg	RM of Spy Hill #152 & RM of Langenburg #181
Wilbert Waldherr	Churchbridge	Individual
Darryl Zentner	Russell	RM of Russell
David Zerr	Langenburg	Langenburg East Conservation Development Area #171

Upper Whitesand Local Watershed Committee

Clark Anderson	Theodore	RM of Garry #245
Wayne Desjarlais	Wadena	Fishing Lake First Nation
Fay Hanson	Foam Lake	RM of Foam Lake #276
Ron Kulyk	Wadena	RM of Sasman #336, Division #3
Lorne Melstad	Margo	RM of Sasman #336, Division #1
Tom Nieckar	Rama	RM of Invermay #305
John Panio	Montmartre	Ottman-Murray Beach, Fishing Lake Watershed Assoc.
Henry Romanovitch	Sheho	Individual
Walter Skihar	Sheho	Individual
Skuli Thorsteinson	Regina	Individual

Lower Whitesand Local Watershed Committee

Darryl Deighton	Canora	Individual
Leon Dutchak	Canora	Individual
James Hupka	Canora	Burgis Conservation & Development Area #134
Metro Kuruliak	Canora	Town of Canora
Isabel Muzichuk	Buchanan	Individual
Fred Petroff	Canora	Buchanan Conservation & Development Area #51
Jack Prychak	Rama	RM of Invermay #305
Ralph Sorestad	Buchanan	RM of Buchanan #304
Paul Stankewich	Canora	Individual
John Swetleshnoff	Canora	Canora Wildlife Federation
Don Wasylyshen	Canora	River Ridge Fish & Game League
Murray Williams	Yorkton	Burgis Beach Cooperative Ltd., Sunnyside Beach Cabin Owners Association at Good Spirit Lake
Louis Wolkowski	Canora	Individual
Bob Yurkowski	Mikado	Individual
Wilfred Zuk	Preeceville	Good Spirit Lake Watershed Association

Yorkton Creek Local Watershed Committee

Bill Anaka	Yorkton	Individual
Jerry T. Cheshuk	Yorkton	City of Yorkton
Fred Cross	Saltcoats	RM of Saltcoats #213
Les Herauf	Yorkton	Individual
Dale Heshka	Melville	City of Melville
John Holowatuk	Yorkton	Individual
Ray Riesz	Yorkton	Individual
Harvey Riffel	Yorkton	Individual

Lake of the Prairies Local Watershed Committee

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Tom Bauereiss	Dropmore	RM of Shellmouth
Geordie Daneliuk	Russell	Russell Game & Fish League
Lawrence Dietrich	Roblin	Shellmouth-Assiniboine Valley Economic Development Group
Wilbert Filipchuk	Kamsack	RM of Cote #271
Elaine Gauer	Roblin	Roblin Soil Conservation Association
Leo Mann	Roblin	Individual
Wayne Ricker	Roblin	Ricker Resorts
Gerald Schepp	MacNutt	RM of Calder #241
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Gerald Zimmer	Roblin	RM of Shell River